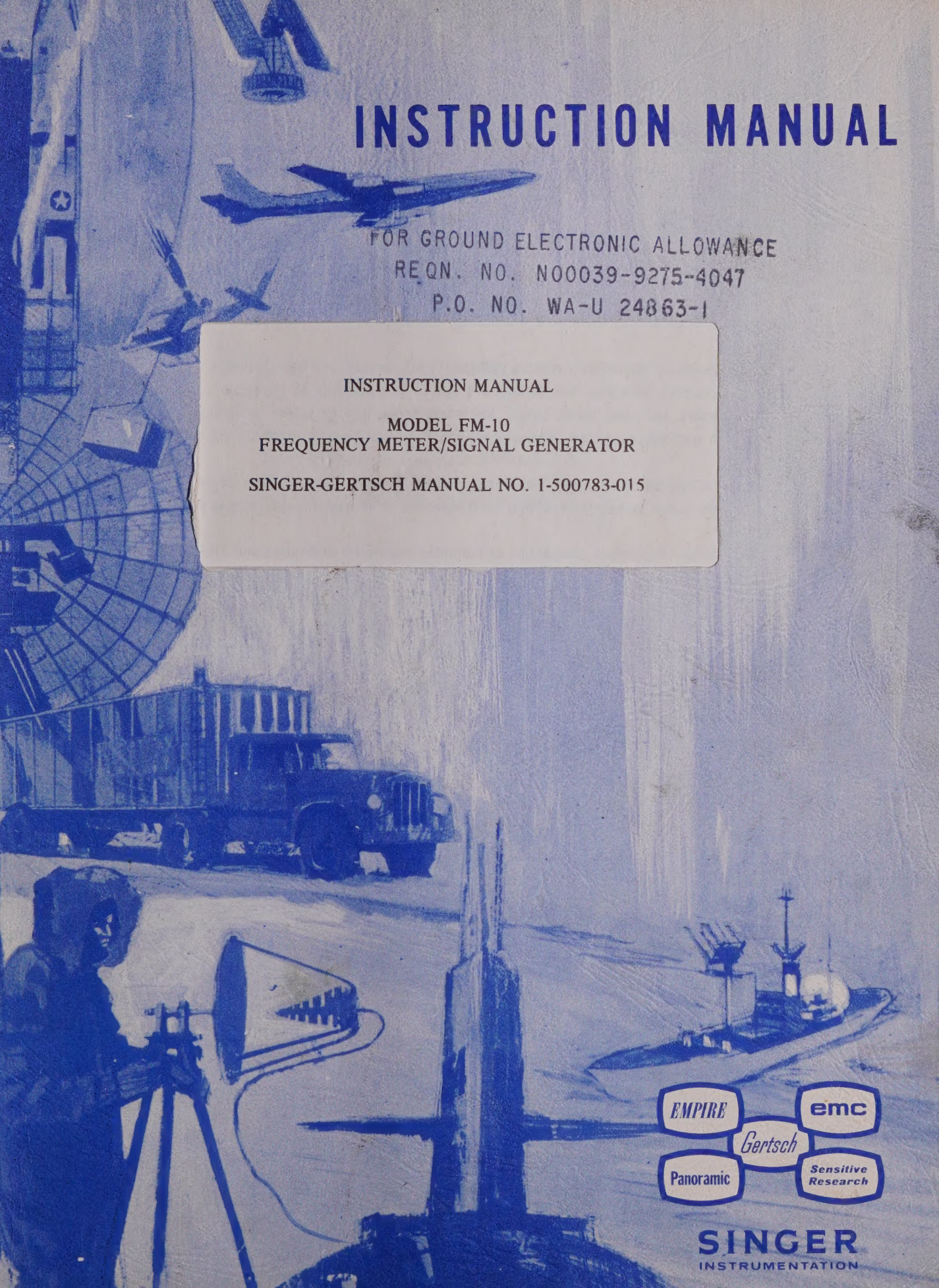




INSTRUCTION MANUAL

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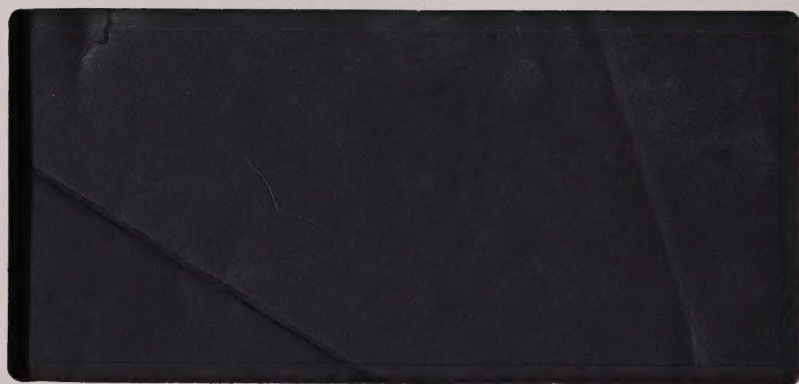
INSTRUCTION MANUAL

MODEL FM-10
FREQUENCY METER/SIGNAL GENERATOR

SINGER-GERTSCH MANUAL NO. 1-500783-015



SINGER
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INSTRUCTION MANUAL

**MODEL FM-10
FREQUENCY METER/SIGNAL GENERATOR
SINGER-GERTSCH MANUAL NO. 1-500783-015**

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| 2. Serial Number | 6. Approximate number of hours of use |
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| 4. Test instruments used | 8. Other comments |

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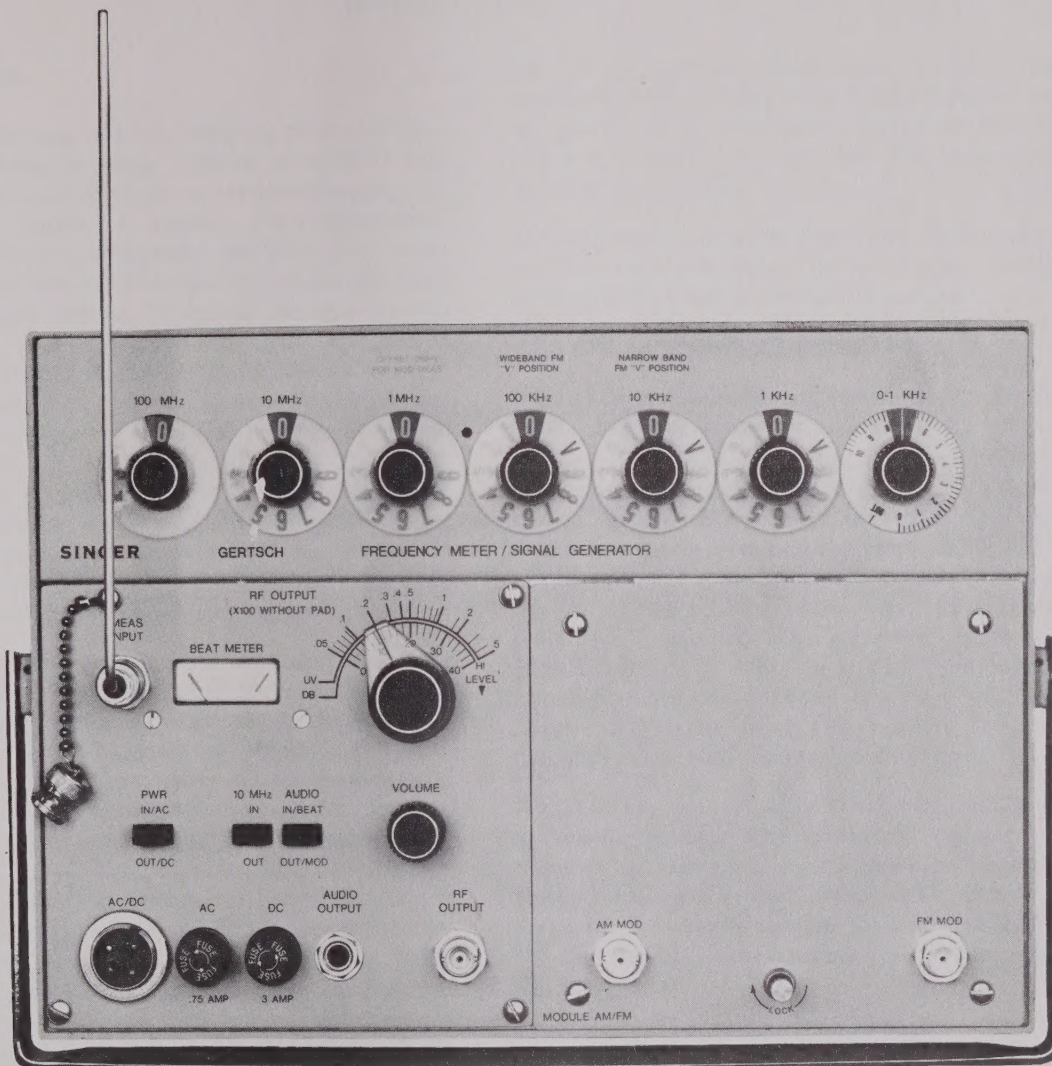


Figure 1-1. Model FM-10, Frequency Meter / Signal Generator.

SECTION I INTRODUCTION

1-1. GENERAL

Model FM-10 is a combination frequency meter and signal generator covering the range 100KHz to 500MHz with direct dial readout. It measures an unknown frequency by comparing it against a known, internally-generated frequency. A built-in loudspeaker and front panel meter present the beat note or error signal in audible and visual forms for quick zeroing. A plug-in antenna permits measurements of frequencies broadcast by remote transmitters. Direct signal input is also possible by means of a front-panel connector. Frequencies between 500MHz and 1GHz can be measured by using the second harmonic and multiplying the dial readout by a X2 factor. The FM-10 functions as a frequency generator by switching in an automatic leveling circuit and a calibrated attenuator. These facilities equip the instrument to deliver a precisely-controlled signal over an 80db voltage range at all points of the instrument's frequency spectrum.

The FM-10 employs a method of direct frequency synthesis in which the output frequency is derived from a mixture of the harmonics and sub-harmonics of a highly-accurate base frequency of 10MHz. The direct synthesis technique ensures that the extreme precision and stability of the reference oscillator are transferred to the output signal. Accuracy is one part per million over a wide temperature range at each kilohertz step. The FM-10 is thus suitable as a laboratory frequency standard. Silicon solid-state devices are used throughout the circuitry and the reference frequency is derived from a state-of-the-art TCXO crystal which requires no temperature oven. The FM-10 is thus operational when it is switched on and does not develop significant heat drift. Calibration of the TCXO crystal against an external source is possible without removal of the instrument covers.

The instrument is entirely self-contained and only requires connection to a standard 12V car battery or a 115/230 VAC mains supply.

Ruggedness is sufficient for heavy field use, while portability is achieved through use of lightweight components and inclusion of a carrying handle.

Six decade switches on the front panel permit selection of any frequency in the operating range to within one kilohertz. A seventh control provides continuous coverage from 0 to 1KHz in 20Hz divisions.

No calibrating or locking procedures are required to set up a specific frequency. Any frequency is obtained simply by setting the six step switches and the seventh variable control to the desired value.

The FM-10 performs many other functions used in communications servicing when ancillary plug-in modules are added to the mainframe. Typical of the ancillary functions available are AM and FM modulation and deviation measurement.

The convenience and durability of the FM-10 qualify it as an all-around instrument for production testing and servicing in the hands of semi-skilled operators.

1-2. USE AS A FREQUENCY METER.

1-3. The signal under investigation is supplied to the front panel BNC connector by cable or by the plug-in antenna. The problem of locating the exact position of the unknown frequency in the spectrum is greatly simplified by means of the interpolating oscillator. This provides continuous sweeps over bandwidths of 1MHz, 100KHz or 10KHz, with one turn of the 0-1KHz control. The operator initiates a search with sweeps over 1MHz bands. The procedure is repeated with successive search bands of 100KHz and 10KHz. When the internal frequency is finally balanced against the unknown frequency with all seven decade switches in circuit, the value of the unknown frequency can be read off from the seven dials.

1-4. The FM-10 uses both a meter and a built-in speaker to present the beat note. The meter permits detection of inaudible frequencies near the zero beat (less than 5Hz). There is a volume control and an audio output jack to supply the beat note to a remote speaker when necessary. A 600-ohm speaker is recommended for proper impedance matching.

1-5. USE AS A SIGNAL GENERATOR

1-6. The FM-10 generates an output sine wave which is precise both in frequency and level over the entire frequency range (AM or FM modulation may also be applied by means of optional plug-in modules). An attenuation range of 80db (0.05 – 500 microvolts) is provided with direct readout in db's or microvolts. It also provides an over-range output up to approximately 5mv where high level outputs are required. The instrument has a sufficiently broad range to test IF's and to sweep discriminators. The precision control of frequency makes for easy testing at specific frequencies such as those at the 3db points.

1-7. PLUG-IN MODULES (Optional Equipment).

1-8. Typical plug-ins are: the Meter Deviation Module (MDM-1) and the Oscilloscope Deviation Module (Model ODM-1). The modules are installed in the front panel and require no rewiring or rework.

1-9. Model MDM-1 provides accurate generation and measurement of FM signals. Total amount of deviation is read directly on the front panel and recovered audio is fed to the built-in speaker. An output from the discriminator circuit of the meter is provided should visual presentation of recovered audio be required. Internal and external modulation signals can be combined by means of a mixing circuit for receiver checkout.

1-10. Module ODM-1 combines an oscilloscope and a discriminator circuit for precision measurements of deviation. A built-in FM modulator combines external and internal modulation signals for receiver checkout.

TABLE 1-1. SPECIFICATIONS

FREQUENCY RANGE	Generate (Leveled)	100KHz to 500MHz (Useable to less 50KHz)
	Generate (Unleveled)	50Hz to 5KHz 500MHz to 1GHz
	Measure	50KHz to 1GHz
FREQUENCY RESOLUTION	Synthesized Mode	1KHz
	Variable Decade	10Hz = 1/2 Div.
VARIABLE DECADE RANGE	Normal	0 - 1KHz
	1KHz Decade	0 - 10KHz
	10KHz Decade	0 - 100KHz
	100KHz Decade	0 - 1MHz
FREQUENCY ACCURACY	Synthesized Mode	0.0001% (1 ppm), -5° to $+50^{\circ}\text{C}$
	Variable Decade	0.0001% $\pm 50\text{Hz}$ at 25°C , $T/C=2\text{Hz}/^{\circ}\text{C}(\text{max})$
	Warm-up Time	"Instant On"
FREQUENCY STABILITY	Residual FM	Less than 100Hz
	Long Term Drift (Ageing)	1 ppm/year
RF OUTPUT	Range: Calibrated sector of variable attenuator	0.05 to 500 μV (50 Ω) with external attenuators supplied
	Range: Uncalibrated sector of variable attenuator	500 μV to 2.5 mV (50 Ω)
	Accuracy	$\pm 3\text{db}$ at 0.5 μV (mid-range)
	Leakage	Less than 0.15 μV measured at 18" from instrument

TABLE 1-1. SPECIFICATIONS (CONT)

MEASURE INPUT SENSITIVITY	50KHz to 1MHz	Less than 50 mV rms
	1MHz to 500MHz	Less than 3 mV rms
	500MHz to 1GHz	Less than 200 mV rms
ZERO BEAT INDICATION	Visual	Meter for beat notes less than 5Hz
	Audio	Built-in speaker and phone jack
MODULATION	FM	Supplied by MDM-1, ODM-1 or AFM-1 (accessory) modules
	AM	Supplied by AFM-1 (accessory) modules
OPERATING VOLTAGE	AC	115/230 vac 50 to 400Hz at 30VA max, without plug-ins
	DC	11.5 to 15 volts at 2 amp maximum without plug-ins
OPERATING TEMPERATURE RANGE		- 5 to + 50°C
WEIGHT		34 pounds without plug-ins
DIMENSIONS		8-3/4"H x 12-1/2"W x 5-5/16"D
RFI		Designed to meet MIL-I-6181D

SECTION II OPERATING INSTRUCTIONS

2-1. GENERAL

2-2. Section II presents full instructions for connecting to a power source, making frequency measurements and generating output signals. Refer to Table 2-1 for explanation for the functions of all controls, indicators and connectors.

2-3. Operation of Model FM-10 is extremely simple and does not involve calibration or locking procedures. Any desired frequency is obtained with full rated accuracy when the power is switched on and the frequency controls are set to the specified value.

2-4. POWER SUPPLY CONNECTIONS.

- a. To use a dc source, 11.5V to 15V:
 - (i) Connect power to the AC/DC connector.
 - (ii) Use the special DC cable assembly provided to connect to a car or truck battery.

NOTE

Make certain that the external source provides a negative ground. Reverse polarity will blow the dc fuse. (FM-10 case is connected to the dc negative line).

- b. To use a 115VAC source:

Plug power cord into 115VAC 3-pin type source.

NOTE

The FM-10 is supplied pre-set to 115VAC for use in North America, unless otherwise indicated by a decal over the AC/DC socket. Power cord supplied is 3-pin for use with 115V grounded mains supply.

- c. To convert to 230VAC operation:
 - (i) Remove instrument cover by removing four screws on the back.
 - (ii) Set voltage switch marked "115" to 230V setting. (This switch is located

behind left hand panel and is exposed when the instrument cover is removed).

- (iii) Replace cover.
- (iv) Plug into source.

2-5. START PROCEDURE.

- a. Switch on power.
 - (i) For dc, press POWER switch to OUT/DC position.
 - (ii) For ac, press POWER switch to IN/AC position.

NOTE

To obtain accuracy of 1×10^{-7} , compare accuracy against higher accuracy standard and adjust TCXO after one hour temperature soak.

2-6. USE AS A FREQUENCY METER

2-7. SET-UP PROCEDURES

2-8. Antenna Set-Up:

Connect antenna provided to MEAS INPUT.

CAUTION

Do not overload the instrument with excessive RF signal. Decrease input level at measure input if required.

2-9. Direct Connection Set-Up.

- a. Connect RFA-60, load and unit under test as shown in Figure 2-1.
- b. If the FM-10 is overloaded, connect RFA-20 in line between FM-10 and RFA-60.

CAUTION

The transmitter power should not exceed 60 watts.

2-10. MEASURING PROCEDURES.

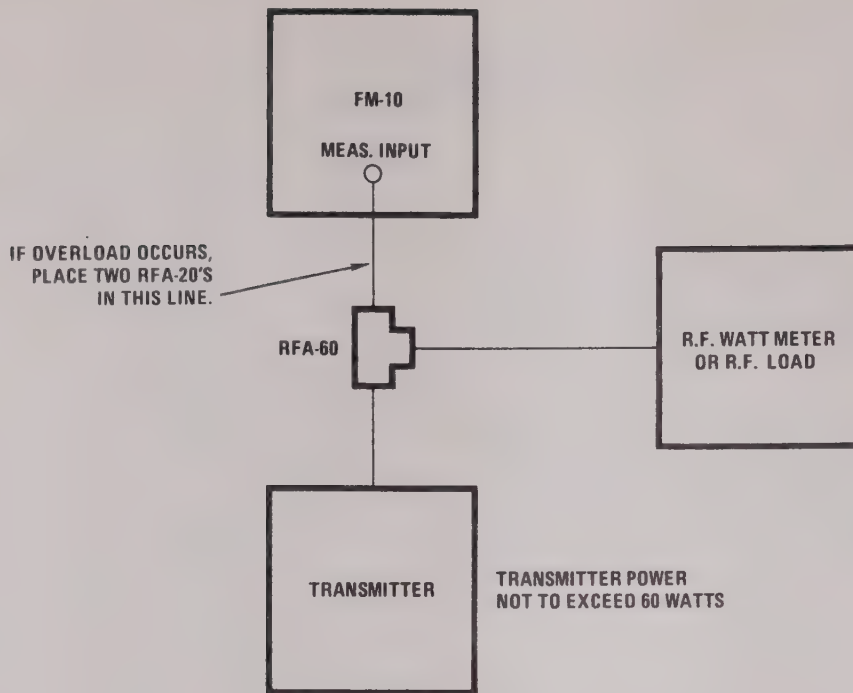


Figure 2-1. Direction Connection, Frequency Measuring Mode

2-11. When the transmitter frequency is within a few hundred hertz of a known channel frequency:

- a. Push 10MHz switch to OUT.
- b. Push AUDIO switch to IN/BEAT.

NOTE

For remote presentation of beat note, connect a speaker to the AUDIO OUTPUT jack. Use VOLUME control to adjust beat note level. Internal speaker is disconnected when an external unit is connected into the AUDIO OUTPUT jack.

- c. Switch decade dials to the channel frequency.
- d. Key the transmitter.
- e. Observe beat note and reduce it to zero by adjusting the "0-1KHz" decade control. (Ensure that none of the other decade controls are switched to the V position.)
- f. Read actual transmitter frequency from decade dials.

2-12. When the transmitter frequency is known only approximately (within a range of one megahertz):

- a. Switch the megahertz decade controls (100MHz, 10MHz and 1MHz) to a frequency slightly below the presumed value.
- b. Switch the 100KHz control to V.
- c. Search for zero beat by turning the "0 - 1KHz" control.
- d. Observe zero beat and read off the position of the "0-1KHz" control (the reading is in 100KHz per division).
- e. Switch the 100KHz control to the value obtained in (d).
- f. Turn 10KHz control to V.
- g. Repeat steps (c) and (d). (The reading is 10KHz per division.) Switch the 10KHz control to the value obtained.
- h. Turn 1KHz control to V.

- i. Repeat steps (c) and (d). (The reading is in 1KHz per numbered division.)
- j. Switch the 1KHz control to the value obtained in (i).
- k. Turn "0-1KHz" control until zero beat is obtained on the beat meter.
- l. Read off exact frequency from all seven decade controls.

2-13. USE AS A SIGNAL GENERATOR. (CW signal only).

2-14. SET-UP PROCEDURE.

- a. Push 10MHz switch to OUT.
- b. Make output connection to RF OUTPUT.
- c. For readout in the range 0.05 to 5 microvolts, connect as shown in figure 2-2. The RF OUTPUT control is calibrated for use with two RFA-20 attenuators in circuit. For readout in the 5 - 500 microvolt range, remove the attenuators and multiply scale reading X 100.
- d. Dial channel frequency on the decade switches.
- e. Adjust signal level with RF OUTPUT control.

CAUTION

Do not key the transmitter while directly connected to FM-10. Keying will burn out the RFA-20 attenuator. If the 40db attenuation is not used and the transmitter is accidentally keyed, a built-in pad behind the input connector to the FM-10 will be destroyed.

2-15. MANUAL FREQUENCY SWEEP PROCEDURE.

2-16. Set-up base frequency and output level as described in 2-14.

2-17. To manually sweep 1MHz:

- a. Switch 100KHz control to V.
- b. Rotate "0-1KHz" control through its full range. The output frequency will increase by 1MHz.

2-18. To manually sweep 100KHz:

- a. Switch 10KHz control to V.
- b. Rotate "0-1KHz" control through its full range. The output frequency will increase by 100KHz.

2-19. To manually sweep 10KHz:

- a. Switch 1KHz control to V.
- b. Rotate "0-1KHz" control through its full range. The output frequency will increase by 10KHz.

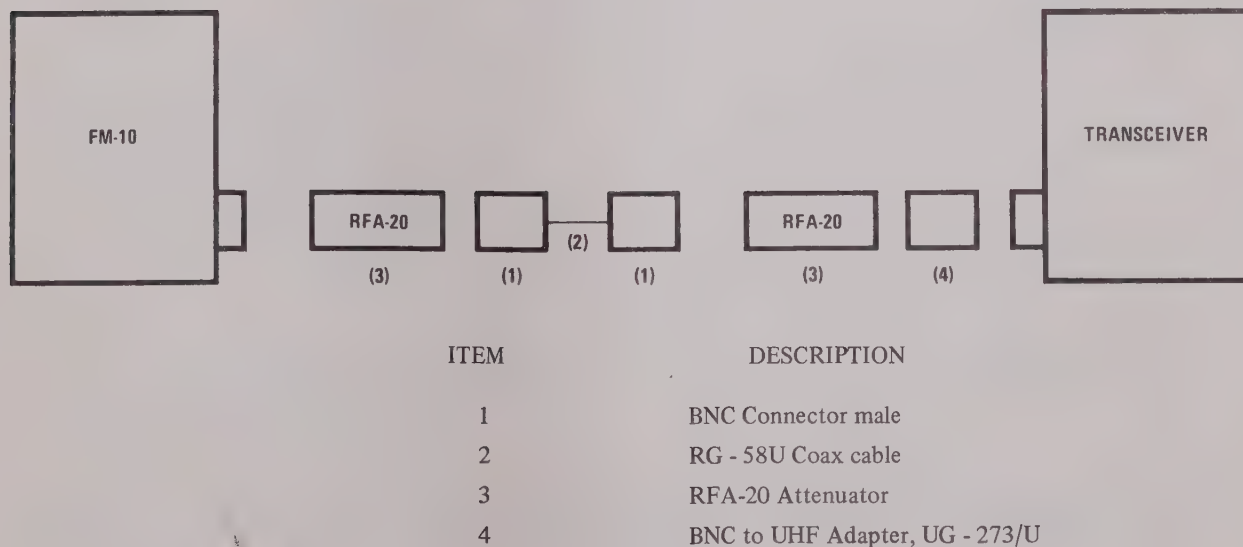


Figure 2-2. Connections for Signal Generator Mode, Using Two RFA-20s.

TABLE 2-1. OPERATING CONTROLS, INDICATORS AND CONNECTORS

ITEM	PANEL MARKING	TYPE	FUNCTIONS
1	<u>100MHz</u> Dial Marking 0-1-2-3-4	Rotary Switch – 5 positions	Controls frequency in four steps of 100MHz
2	<u>10MHz</u> Dial Marking 0-1-2-3-4-5-6-7-8-9	Rotary Switch – 10 positions	Controls frequency in ten steps of 10MHz
3	<u>1MHz</u> OFFSET 2MHz for MOD MEAS Dial Marking 0-1-2-3-4-5-6-7-8-9	Rotary Switch – 10 positions	Controls frequency in ten steps of 1MHz
4	<u>100KHz WIDEBAND FM “V”</u> <u>POSITION</u> Dial Marking 0-1-2-3-4-5-6-7-8-9-V	Rotary Switch, 11 positions	Controls frequency in 10 steps of 100KHz. “V” position switches 0-1KHz control (item 7) into circuit with continuous control over range of 1MHz.
5	<u>10KHz NARROWBAND FM “V”</u> <u>POSITION</u> Dial Marking 0-1-2-3-4-5-6-7-8-9-V	Rotary Switch, 11 positions	Controls frequency in ten steps of 10KHz. “V” position switches the 0-1KHz control (item 7) into circuit with continuous control over range of 100KHz.
6	<u>1KHz</u> Dial Marking 0-1-2-3-4-5-6-7-8-9-V	Rotary Switch, 11 positions	Controls frequency in 10 steps of 1KHz. “V” position switches the 0-1KHz control into circuit with continuous control over range of 10KHz.
7	<u>0-1KHz</u> Dial Marking 0-1-2-3-4-5-6-7-8-9-10-OUT	Potentiometer / Switch	Controls frequency continuously over four ranges: 0-1KHz 0-10KHz (1KHz control in V position) 0-100KHz (10KHz control in V position) 0-1MHz (100KHz control in V position) Frequency range of this potentiometer is 0-1KHz when switches 1KHz, 10KHz and 100KHz are not in “V” position.
8	MEAS INPUT	Connector, BNC Female	Input connector
9	BEAT METER	Meter	Follows positive voltage excursion of beat note. Provides visual indication of beat note frequency when frequency is less than 5Hz.
10	RF OUTPUT (X 100 WITHOUT PAD)	Attenuator scaled in db's and microvolts with uncalibrated “HI” range.	Controls R.F. output. Scale markings are based on use of 40db external attenuators. If no external attenuator is used, multiply millivolt scale reading by X 100.

TABLE 2-1. OPERATING CONTROLS, INDICATORS AND CONNECTORS (CONT)

ITEM	PANEL MARKING	TYPE	FUNCTIONS
11	PWR IN/AC – OUT/DC	Switch, pushbutton	Controls power supply. Push to IN position for AC. Push to OUT position for DC.
12	10MHz, IN OUT	Switch, pushbutton	Applies 10MHz signal direct from TCXO crystal to detector. Produces audio frequency at phone jack with same accuracy as TCXO.
13	AUDIO IN / BEAT OUT / MOD	Switch, pushbutton	Switches loudspeaker into beat detector circuit. This switch should be in the IN position at all times except when a plug-in module is used.
14	VOLUME	Potentiometer	Controls speaker volume and output at AUDIO OUTPUT connector.
15	AC / DC	Connector, socket	Provides connection to AC or DC source.
16	AC	Fuse	Protects 115/230 VAC input circuits.
17	DC	Fuse	Protects DC input circuit.
18	AUDIO	Connector, phone jack	Supplies audio output signal
19	RF OUTPUT	Connector BNC Female	Supplies calibrated output controlled by RF OUTPUT attenuator.

SECTION III THEORY OF OPERATION

3-1. GENERAL (See Figures 3-1 and 3-2.)

3-2. When the Model FM-10 is used as a frequency meter, unknown signals are compared to the output of a frequency synthesizer in a beat detector circuit. The resultant beat notes are amplified and applied to a beat meter, phone jack, and built-in speaker. Output level is set by a VOLUME control.

3-3. When the Model FM-10 is used as a signal generator, the output of the frequency synthesizer is applied to a BNC connector (RF OUTPUT) through a variable 80db attenuator. An automatic level-control circuit is included to maintain a constant output over the frequency range. Until one of the modules is plugged-in, the output is a CW signal.

3-4. Through the use of the optional ODM or MDM modules, the instrument is converted to AM or FM use. The modules check peak deviations of modulation and act as sources for modulating the output of the frequency synthesizer.

3-5. FREQUENCY SYNTHESIZER (See Figure 3-3.) The output of the frequency synthesizer consists of various frequency elements which are derived from the 10MHz crystal by a process of frequency division and multiplication. These frequency elements are mixed, filtered and amplified to form the output signal.

3-6. A typical synthesis process is shown in Figure 3-3. The interpolating oscillator is switched into the system and supplies the smallest element (0.78KHz). This oscillator is continuously variable from 6MHz, which represents a 0.00KHz setting, to 5MHz, which represents a 1.00KHz setting. The 0.78KHz setting results in a frequency of 5.22MHz. In the mixing process the 5MHz portion is eliminated and the 0.22MHz portion passes through three divide-by-ten stages to become a 220Hz signal. In the final subtraction process, the 220Hz signal becomes a 780Hz output portion.

3-7. The 1KHz portion of the output signal is supplied by one of the ten fixed frequency generators. These generators vary in frequency from 3.6MHz (representing 0) to 4.5MHz (representing 9). The 4.2MHz signal selected by the 1KHz switch therefore represents a 6. The first signal mixing process is typical for the system; the 5.22MHz signal from the interpolating oscillator is divided by ten and then added to 9MHz in a balanced mixer, thus becoming 9.522MHz. The 4.2MHz signal is subtracted leaving a resultant frequency of 5.322MHz.

3-8. Figure 3-4 illustrates the method by which the 10MHz crystal controls the output signal. In this portion alone, eight separate frequencies are derived directly from the crystal. Through a similar process, the generators for the 1MHz, 10MHz and 100MHz elements are also controlled.

3-9. The 10MHz crystal output is divided by five (2MHz), two (1MHz), and ten to provide a 100KHz signal for controlling the generators. Through a precision filter, the 42nd harmonic of 100KHz is selected and amplified to form the 4.2MHz signal which represents a 6. The ten generators supply the signals for the 1KHz, 10KHz and 100KHz decades.

3-10. The 9MHz signal used in the mixing process, is derived from the available 1MHz signal through two multiply-by-three stages. This mixing process results in an output signal between 5 and 6MHz, which can be filtered to eliminate unwanted mixer by-products.

3-11. When the interpolating oscillator is switched out of the system, a fixed 6KHz is substituted. This signal represents a 00 setting and is derived from the crystal. At the 1KHz increments, all of the elements of the synthesizer frequency are derived from the crystal.

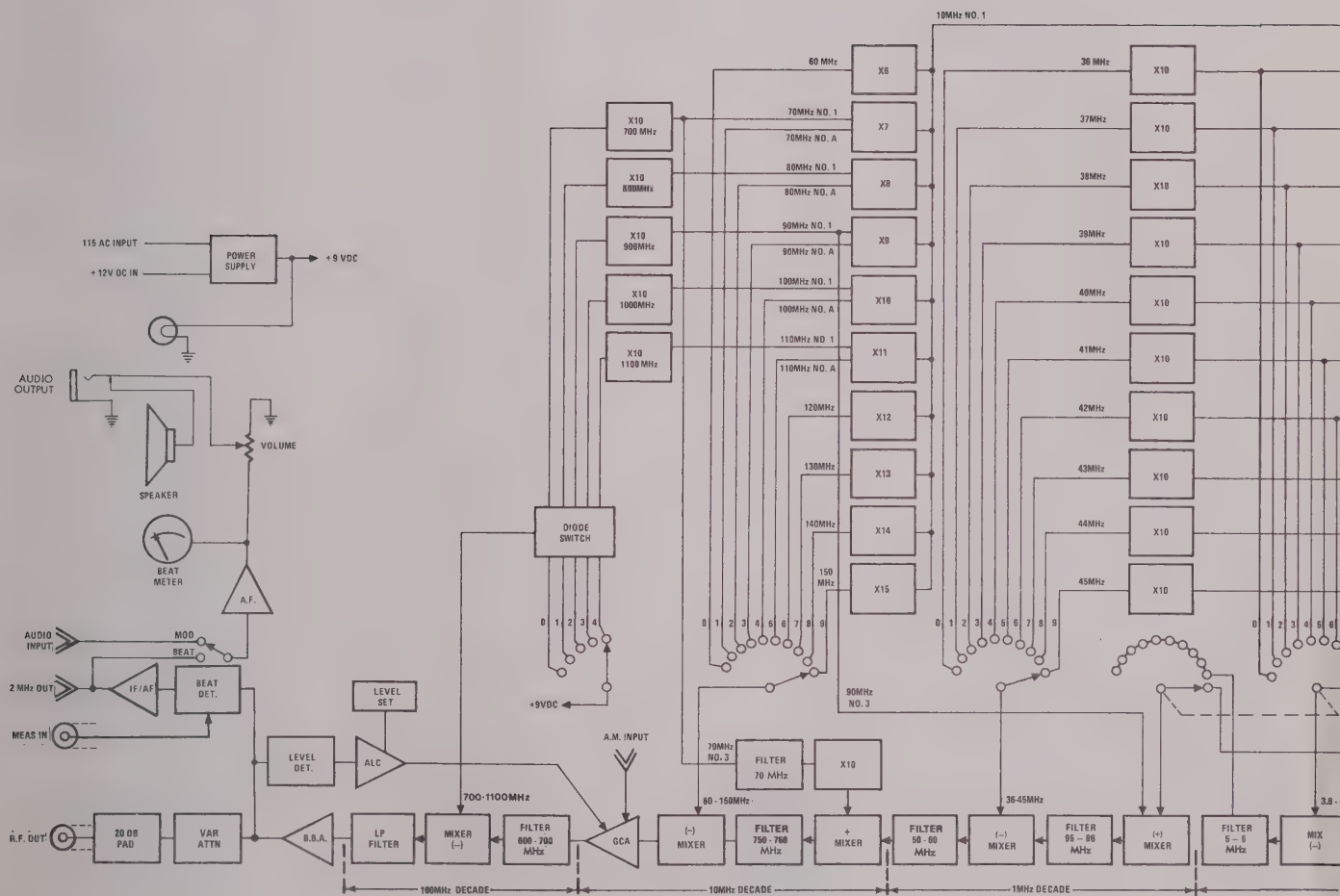
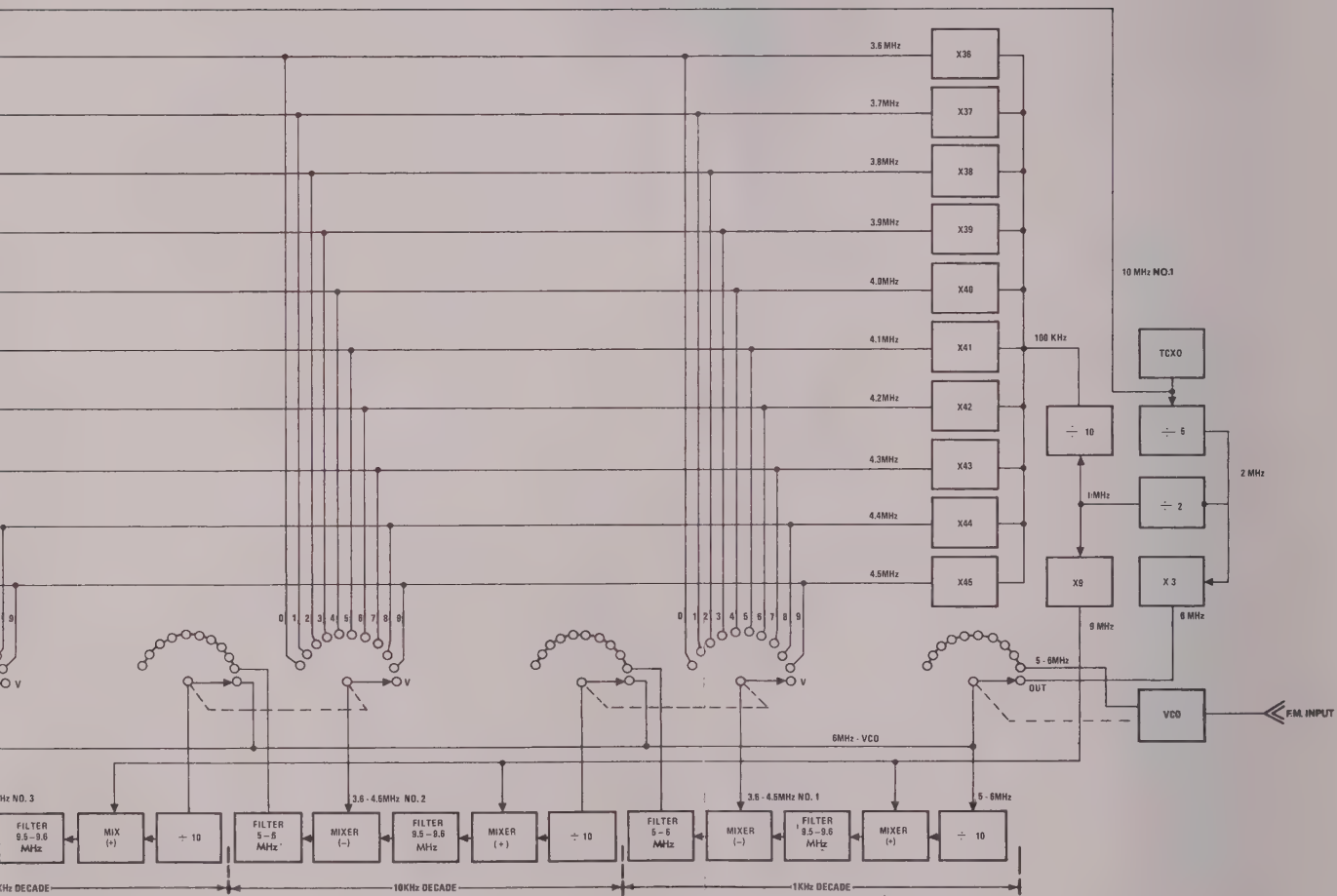


Figure 3-1. Overall Block Diagram



Block Diagram

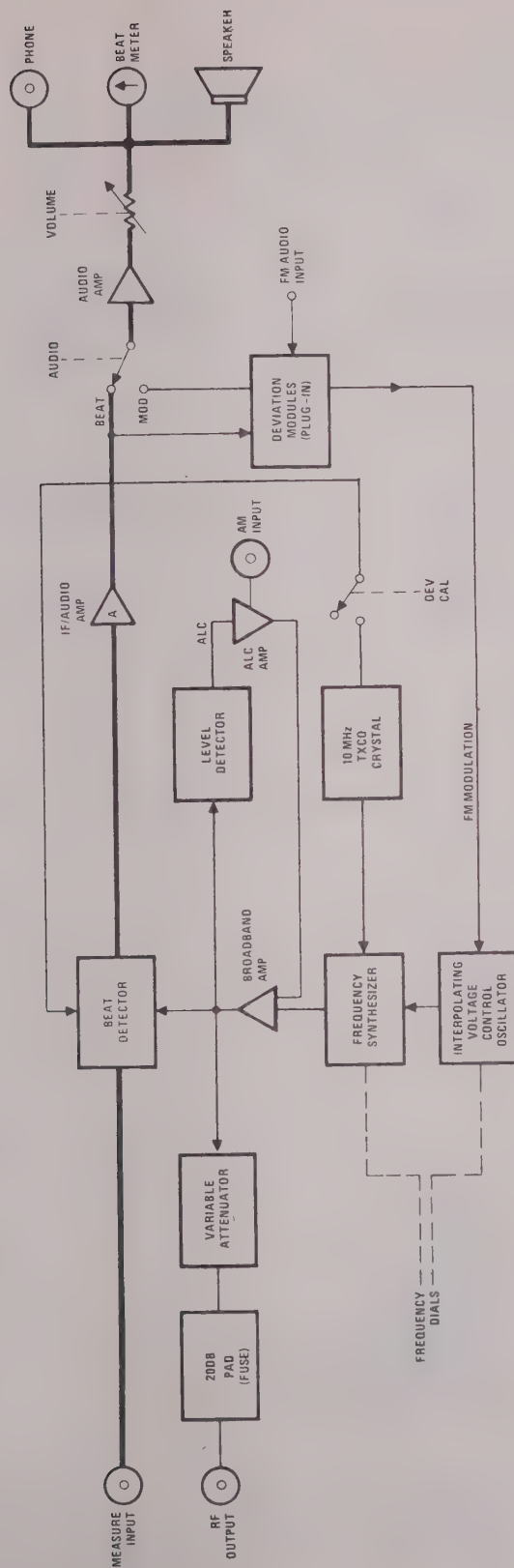


Figure 3-2. Simplified Block Diagram – FM-10

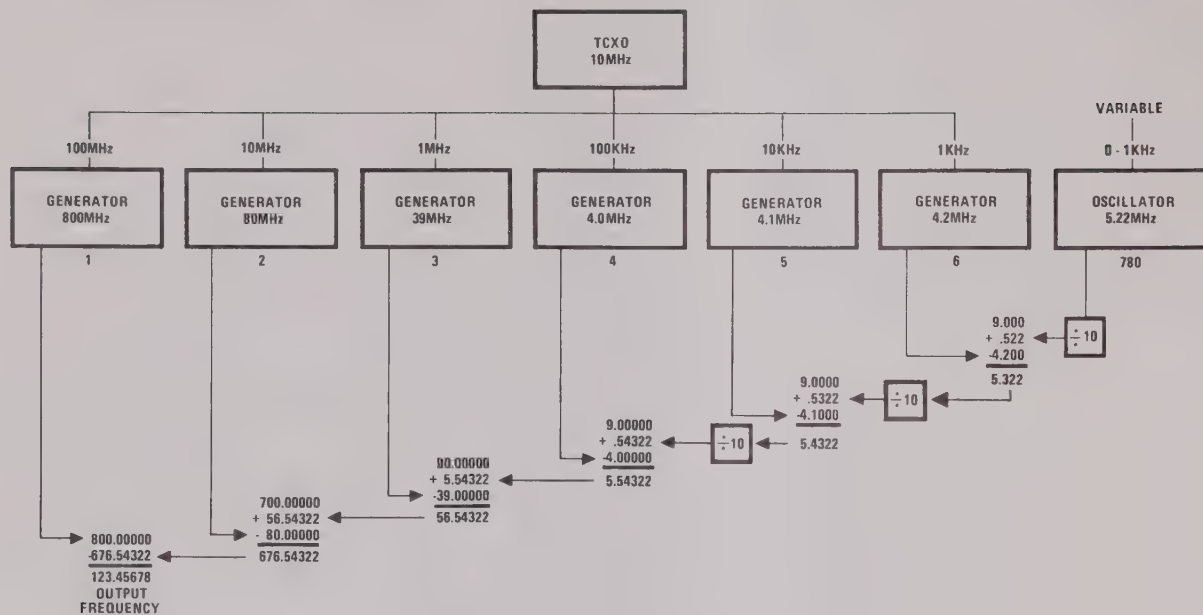


Figure 3-3. Typical Frequency Synthesis

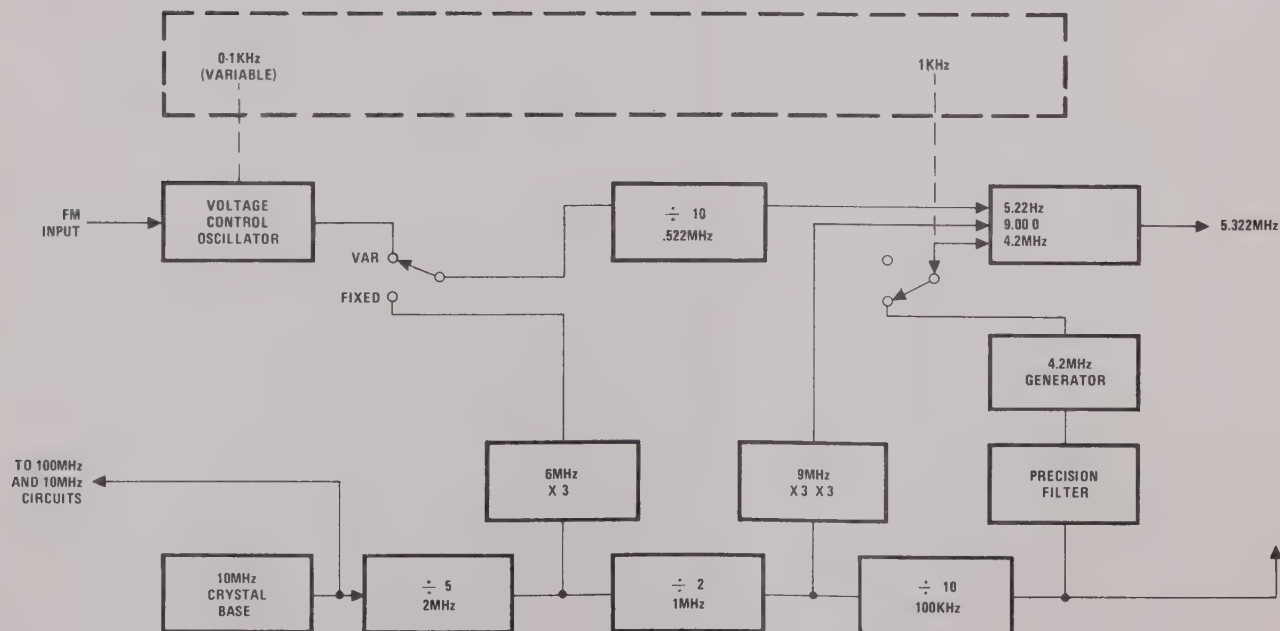


Figure 3-4. Frequency Deviation

SECTION IV MAINTENANCE

4.1 GENERAL

4-2. Return the unit to an Authorized Service Center for all repairs and adjustments. Instructions are given below for calibration of the TCXO crystal by the owner, but calibration by the factory is recommended.

4-3. CALIBRATION OF TCXO CRYSTAL.

4-4. Adjust the TCXO crystal every three months for first year of operation and once every year thereafter.

4-5. The most convenient method of calibrating the TCXO crystal is to use a standard receiver such as the Singer-Gertsch RLF-1. If such an instrument is not available, the Lissajous figure technique may be employed.

4-6. Adjustment using RLF-1.

- a. Connect RF OUTPUT connector of FM-10 to an amplifier with 35db gain.
- b. Connect amplifier to RLF-1 as outlined in RLF-1 manual.
- c. Set FM-10 for 1MHz and 2.5mv output.
- d. Set RLF-1 for 1MHz operation.

- e. Switch on power to FM-10, RLF-1 and amplifier.
- f. Allow one hour soak to ambient temperature ($25^{\circ} - 38^{\circ}\text{C}$).
- g. Slide the hinged cover plate away from TCXO crystal access hole in the left side panel of the FM-10.
- h. Adjust frequency of crystal by turning screw head with screwdriver.
- i. Set frequency so that maximum error is one part in 10^7 using an error measurement procedure described in the RLF-1 manual.

4-7. ADJUSTMENT USING LISSAJOUS FIGURE.

- a. Connect FM-10, 1MHz frequency standard and an oscilloscope into a Lissajous figure test set-up.
- b. Set FM-10 for 1MHz operation.
- c. For 1×10^{-7} accuracy, adjust TCXO crystal so that Lissajous pattern executes two reversals in 10 seconds.

SECTION V SCHEMATICS

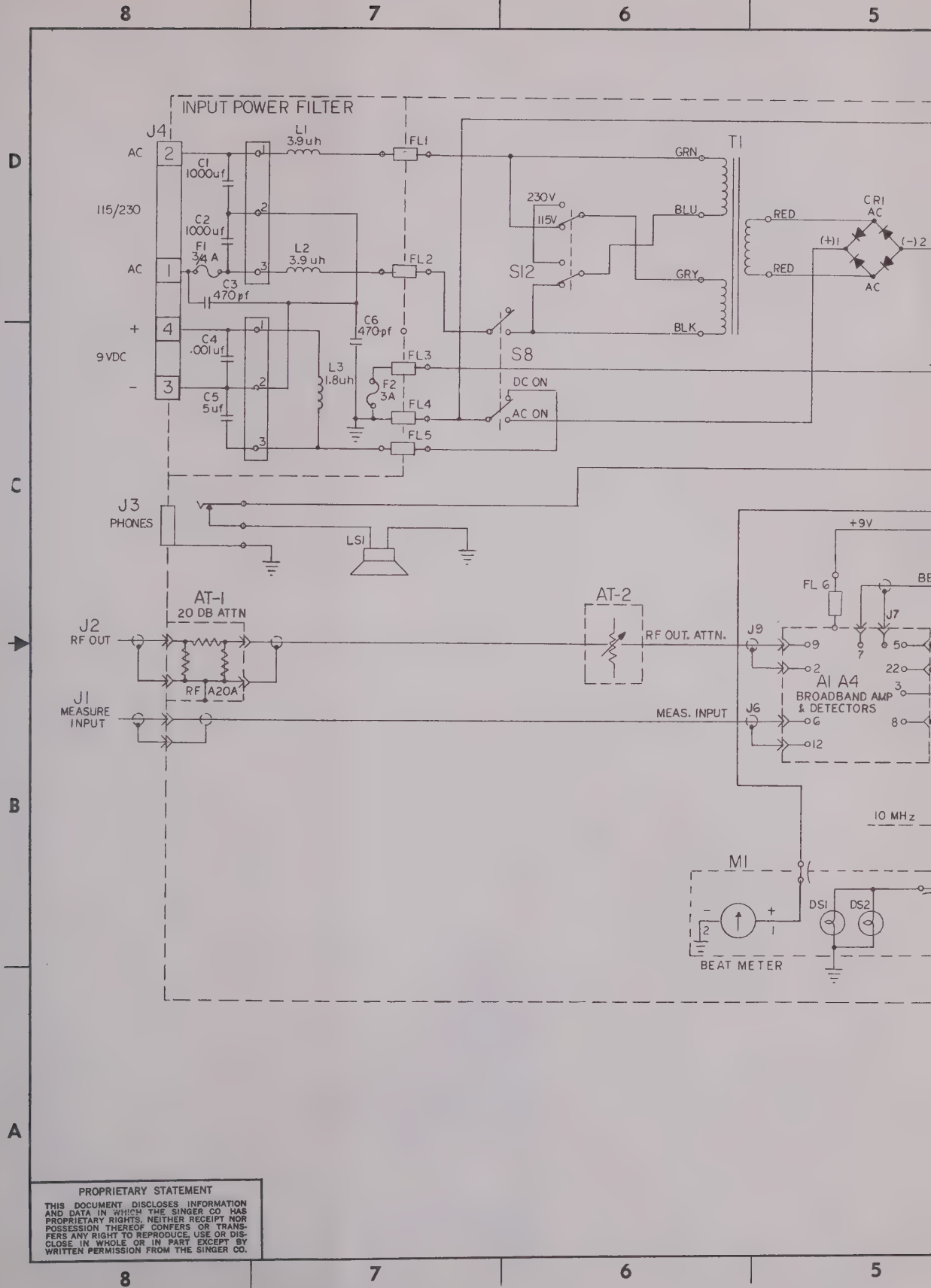


Figure 5-1. Left Handle Model

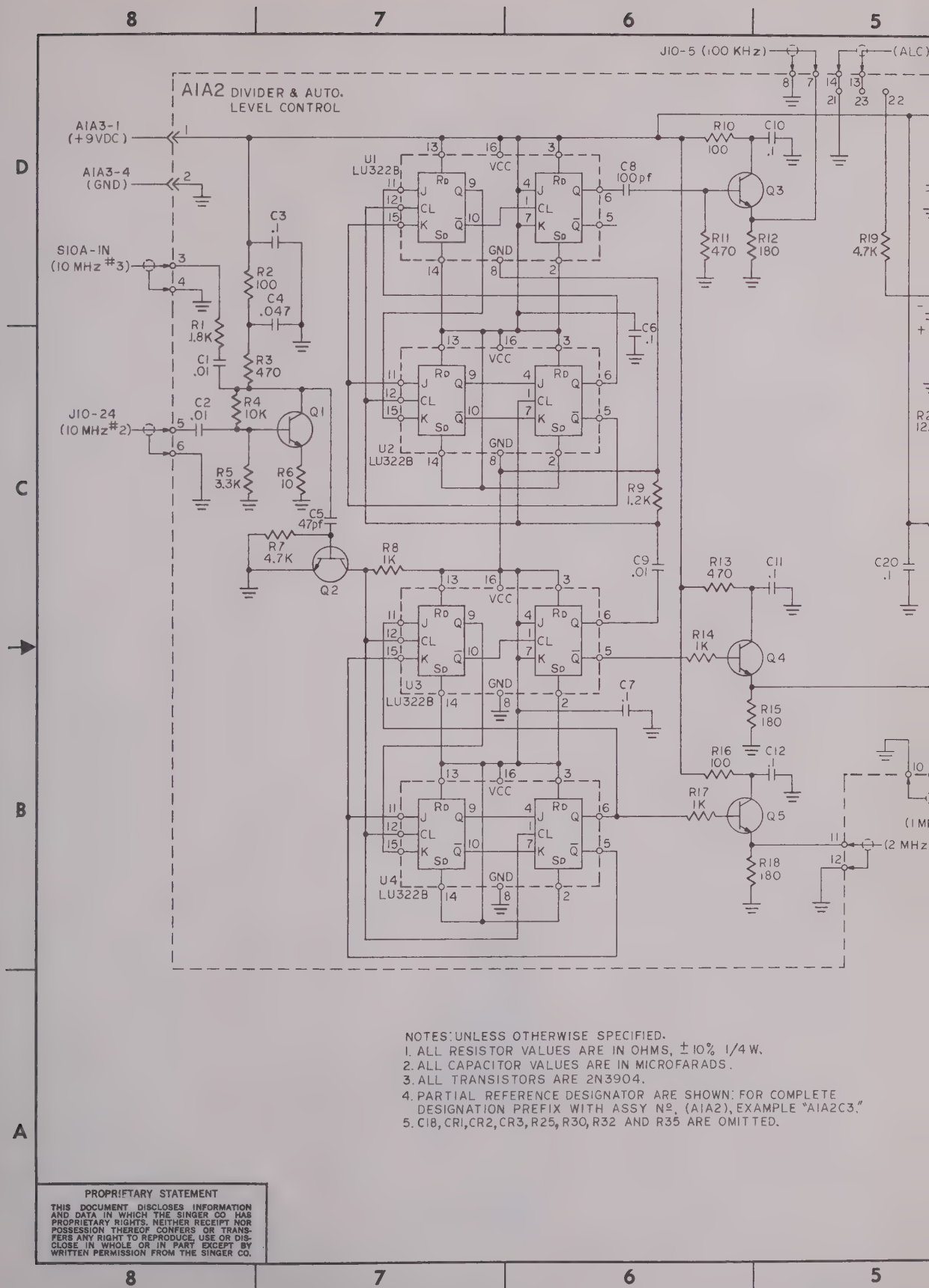
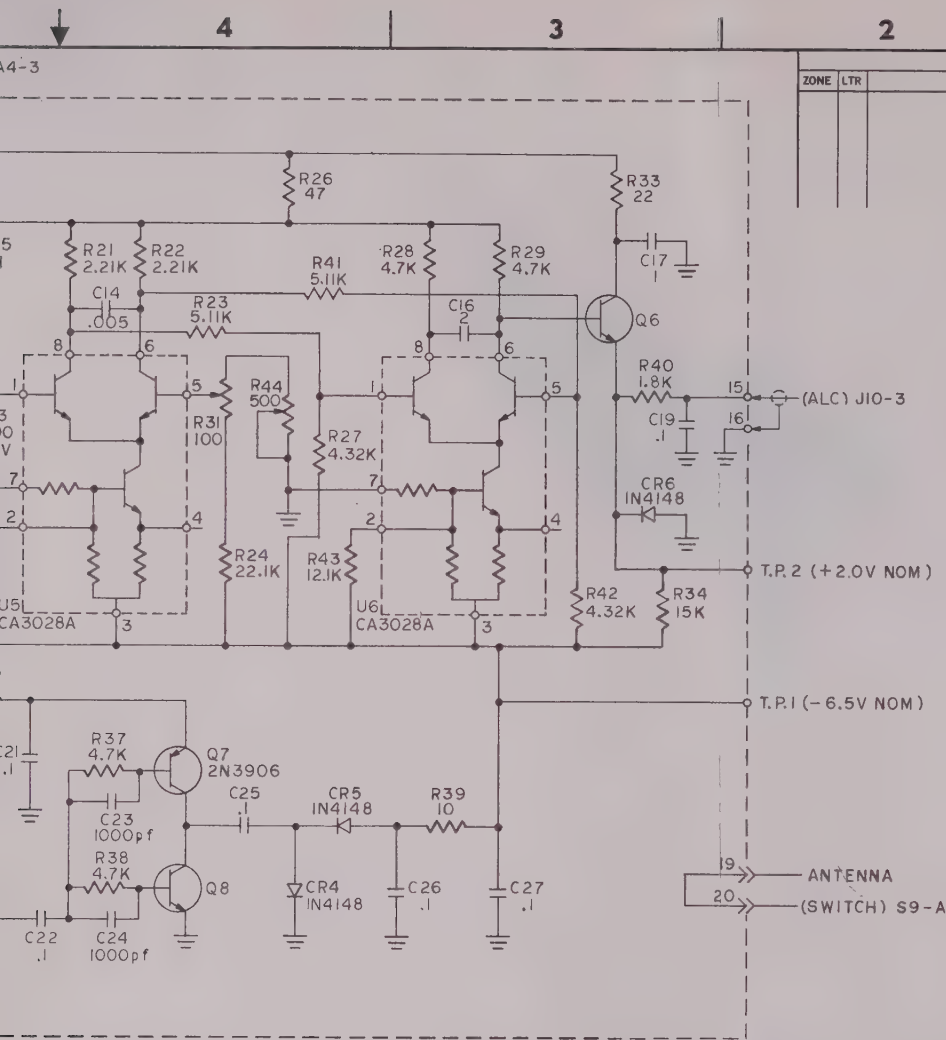


Figure 5-2. Divider and Auto



REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

J10-1
0-16

C27
CR6
R44
Q8
TP2
U6
LAST REF DES
(INCLUSIVE)

QUANTITY REQUIRED	CONTRACT NO.	NAME	DATE	DESCRIPTION	PART NO.	1
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DIMENSIONS DECIMAL ANGULAR 2 PLACE ± 3 PLACE ±	DRAWN	<i>Boyle</i>	10-24-69			
MATERIAL	CHECK					
FINISH	ELEC ENGR					
MODEL NO.	MECH ENGR					
	APPROVED	<i>R.P.</i>	30 OCT 69			
	SIZE	CODE IDENT NO.	DWG NO.			
	D	88869	4-500953-001			
	SCALE					

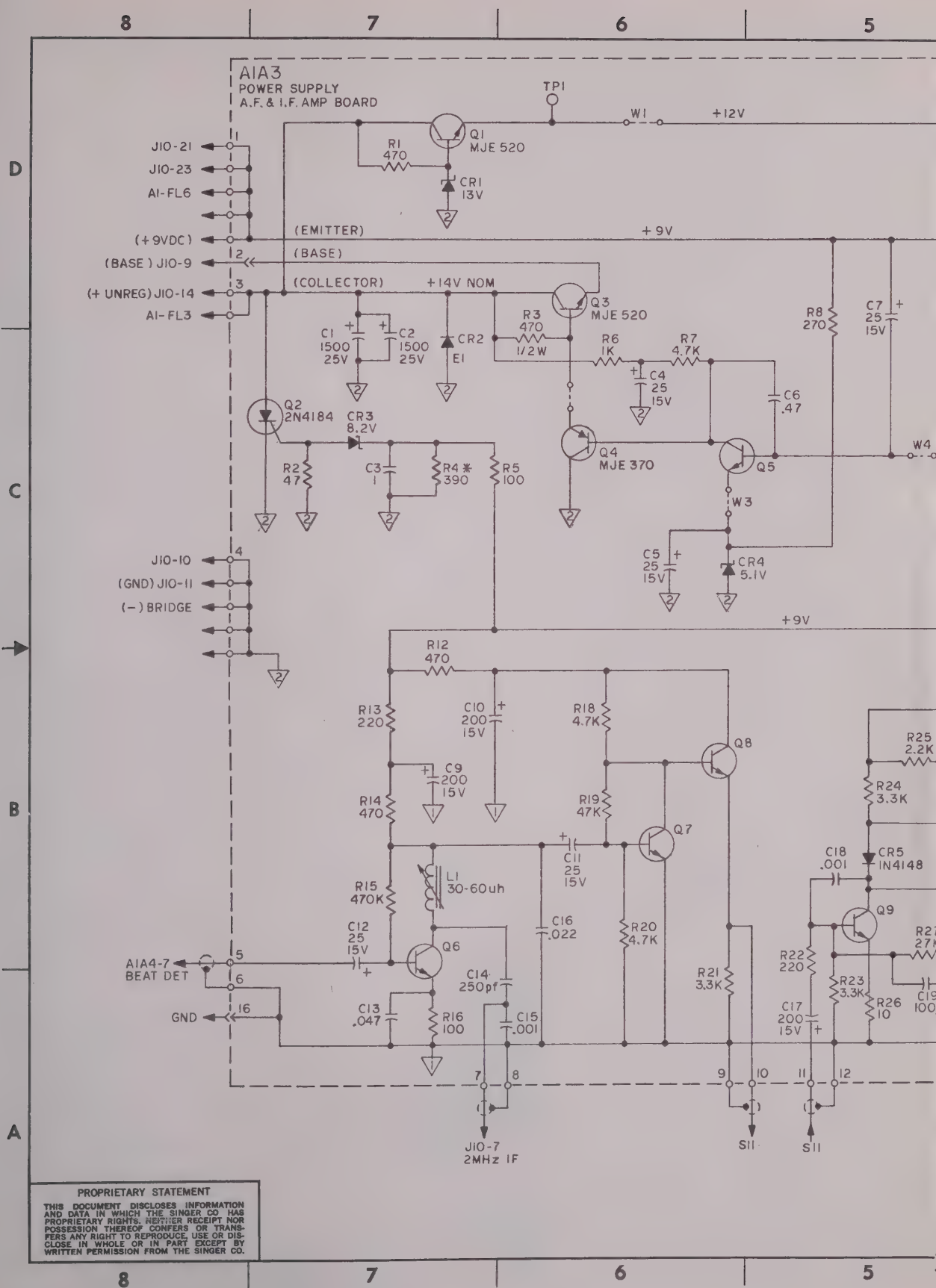


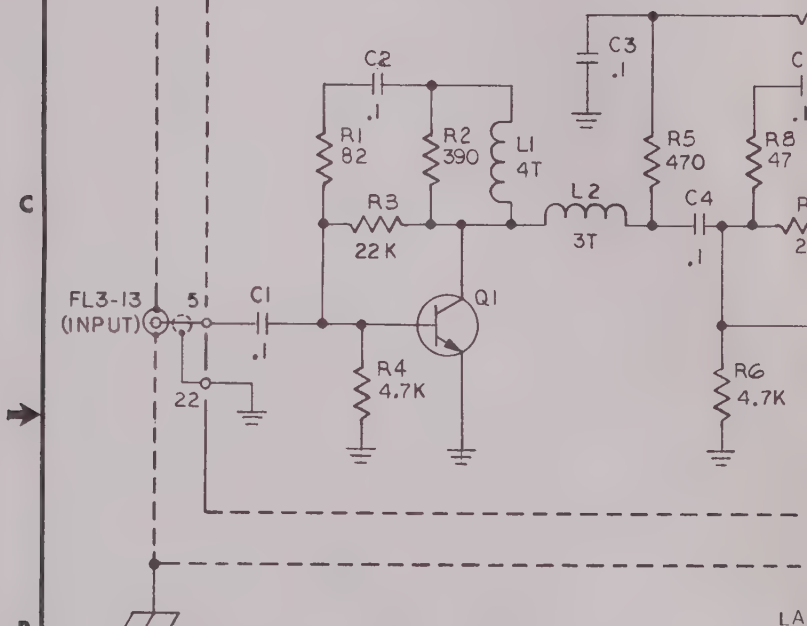
Figure 5-3. Power Supply, AF and IF Am

ISSUE	PCH. NO.	CHANGE	DATE	CHK.	ISSUE	PCH. NO.	CHANGE

D

AI CHASSIS

AIA4

BROAD BAND AMPL
& DETECTOR BOARD

B

NOTES: UNLESS OTHERWISE SPECIFIED.

1. ALL RESISTOR VALUES ARE IN OHMS, $\pm 10\%$, 1/4W
2. ALL CAPACITOR VALUES ARE IN MICROFARADS, 200V.
3. ALL TRANSISTORS ARE 2N5179.
4. ALL DIODES ARE GENERAL ELEC PART NO. BD3.

* 5. FACTORY SELECTED VALUE.

6. PARTIAL REFERENCE DESIGNATORS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH ASSY NO. (AIA4), EXAMPLE "AIA4"

A

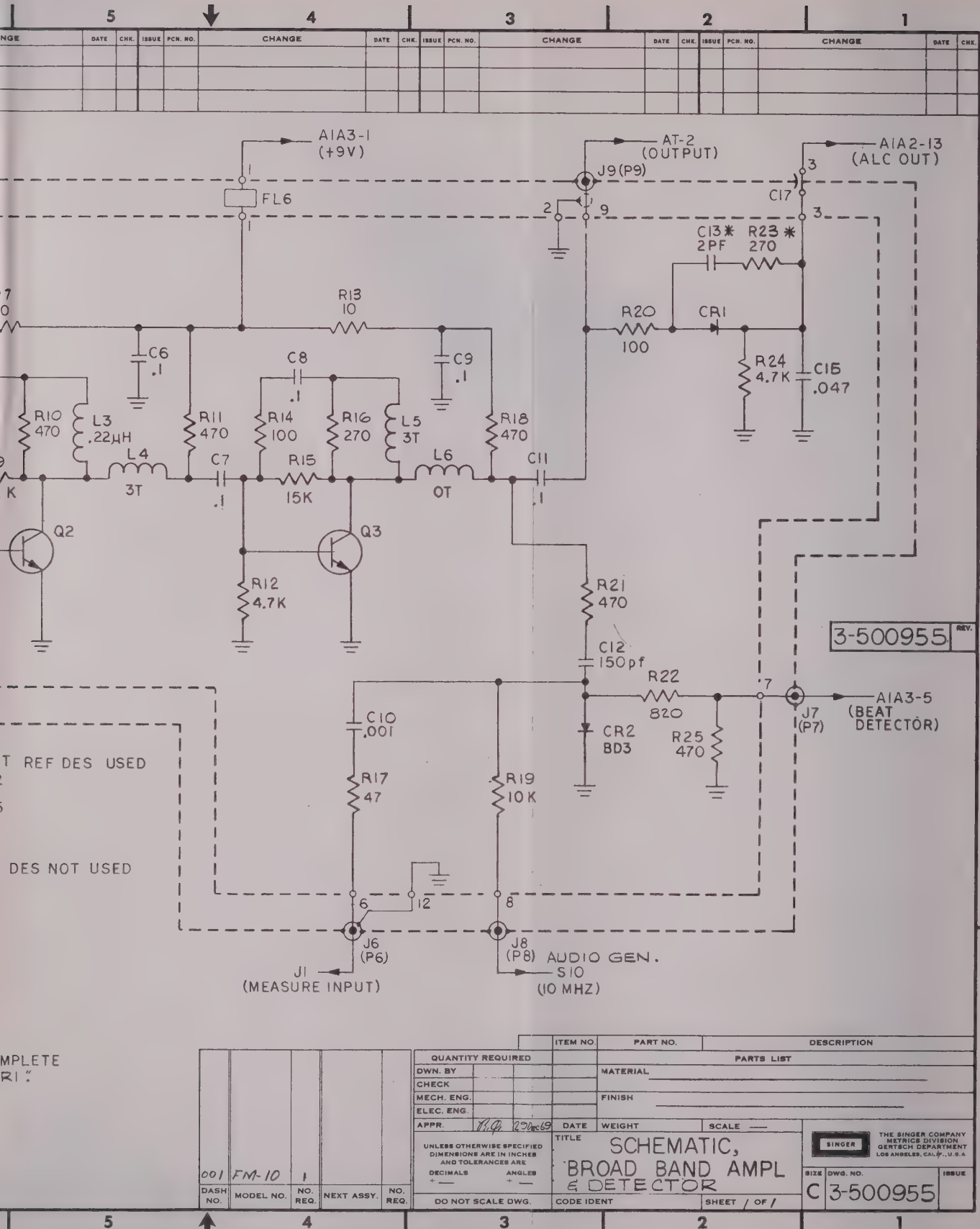


Figure 5-4. Broad Band Amplifier and Detector Schematic Diagram (A1A4)

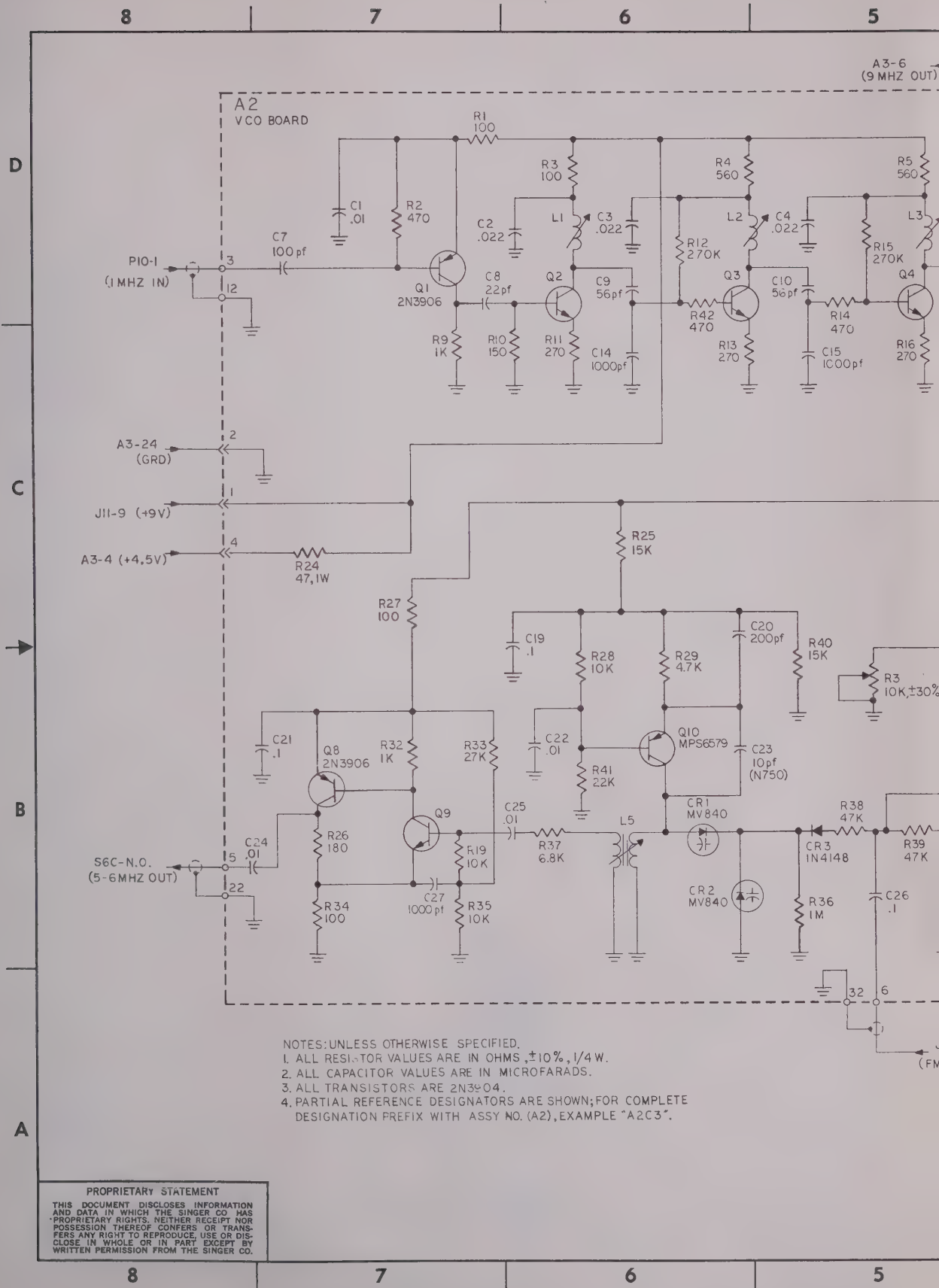
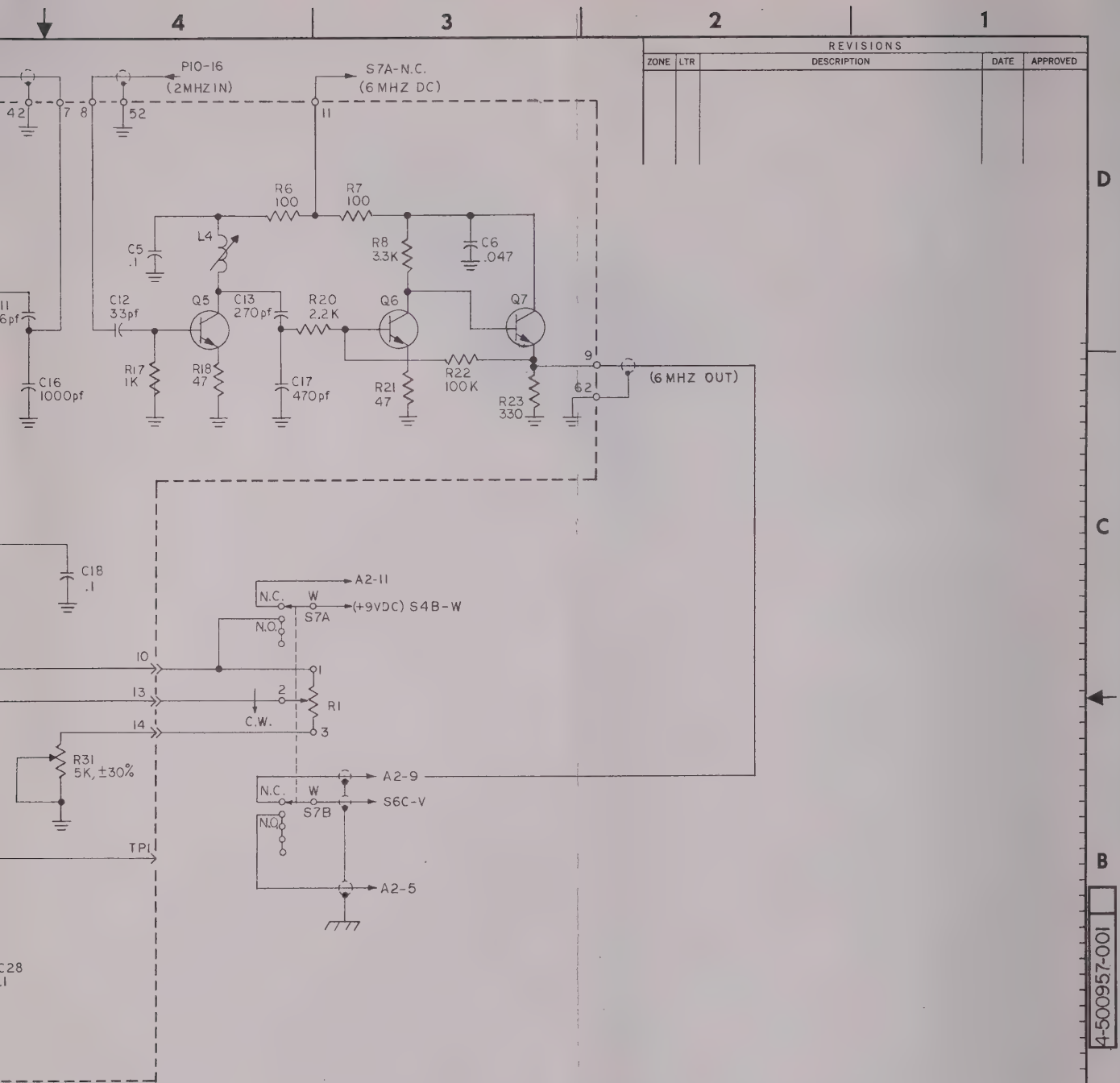
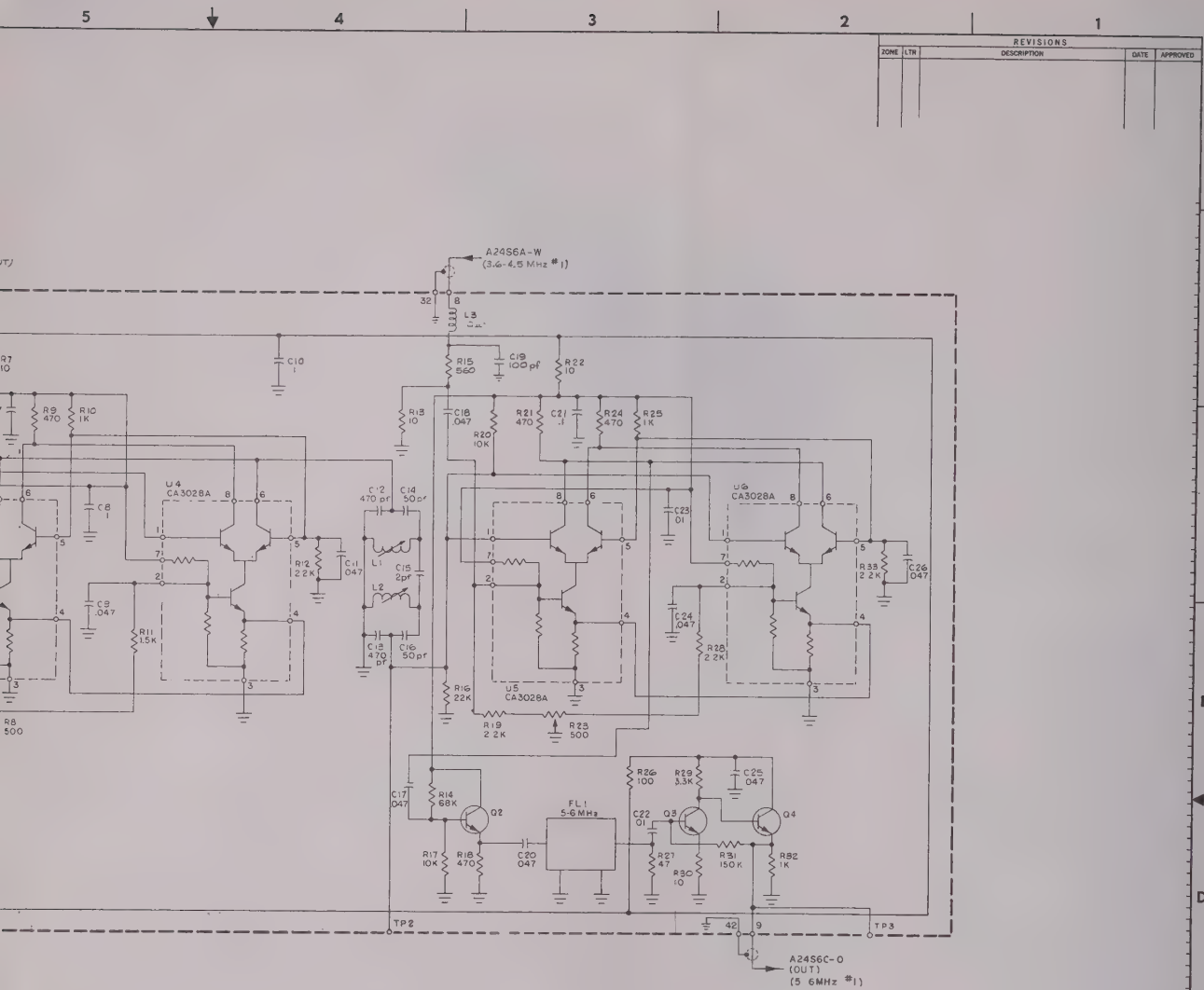


Figure 5-5. VCO, 6 and 9



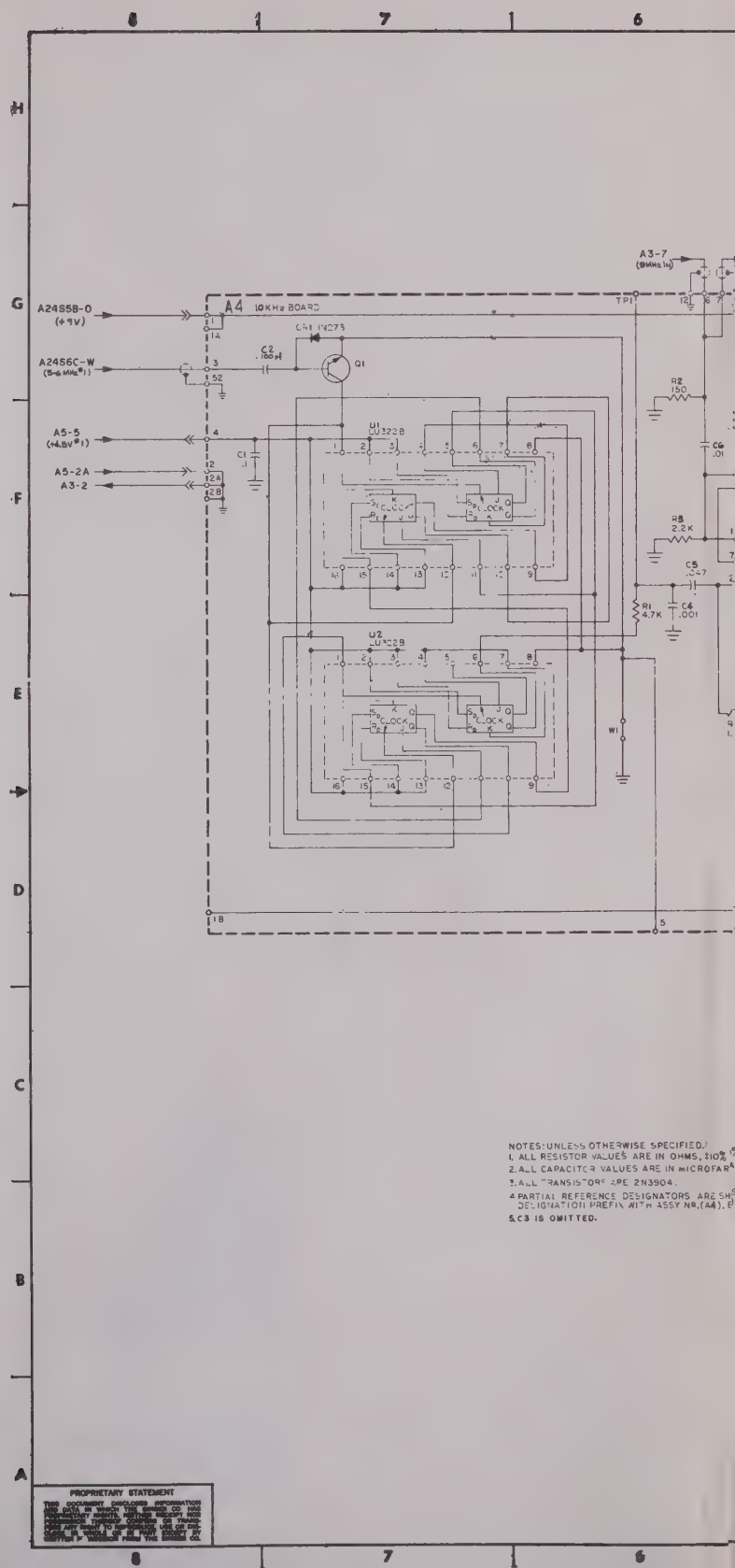
					DESCRIPTION		PART NO.	1
QUANTITY REQUIRED					LIST OF MATERIALS			
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DIMENSIONS					SINGER THE SINGER CO - METRICS DIV GERTSCH DEPT. LOS ANGELES, CALIF.			
DECIMAL 2 PLACE ± 3 PLACE ±					SCHEMATIC VOLTAGE CONTROL OSC (A 2)			
MATERIAL					SIZE CODE IDENT NO. DWG NO. D 88869 4-500957-001			
FINISH					SCALE SHEET OF			
LAST REF DES (INCLUSIVE)								
MODEL NO. FM-10								





QUANTITY REQUIRED		DESCRIPTION		PART NO.		ITEM	
455	456	457	458	459	460	461	462
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DIMENSIONS DECIMAL 3 PLACE ± * ANGULAR 3 PLACE ± *				LIST OF MATERIALS			
CONTRACT NO.				DATE			
DRAWN				DATE			
CHECK				DATE			
ELEC ENGR				DATE			
MECH ENGR				DATE			
APPROVED				DATE			
MATERIAL				DATE			
FINISH				DATE			
MODEL NO.				DATE			
FM-10				DATE			
LAST REV DES (INCLUSIVE)				DATE			
SINGER				THE BENDER CO - MATRICES DIV			
SCHEMATIC				1KHz DECADE			
(A3)				DATE			
E 88869				5-500958-001			
SCALE				SHEET 1 OF 3			

-6. 1KHz Decade (A3) Schematic Diagram



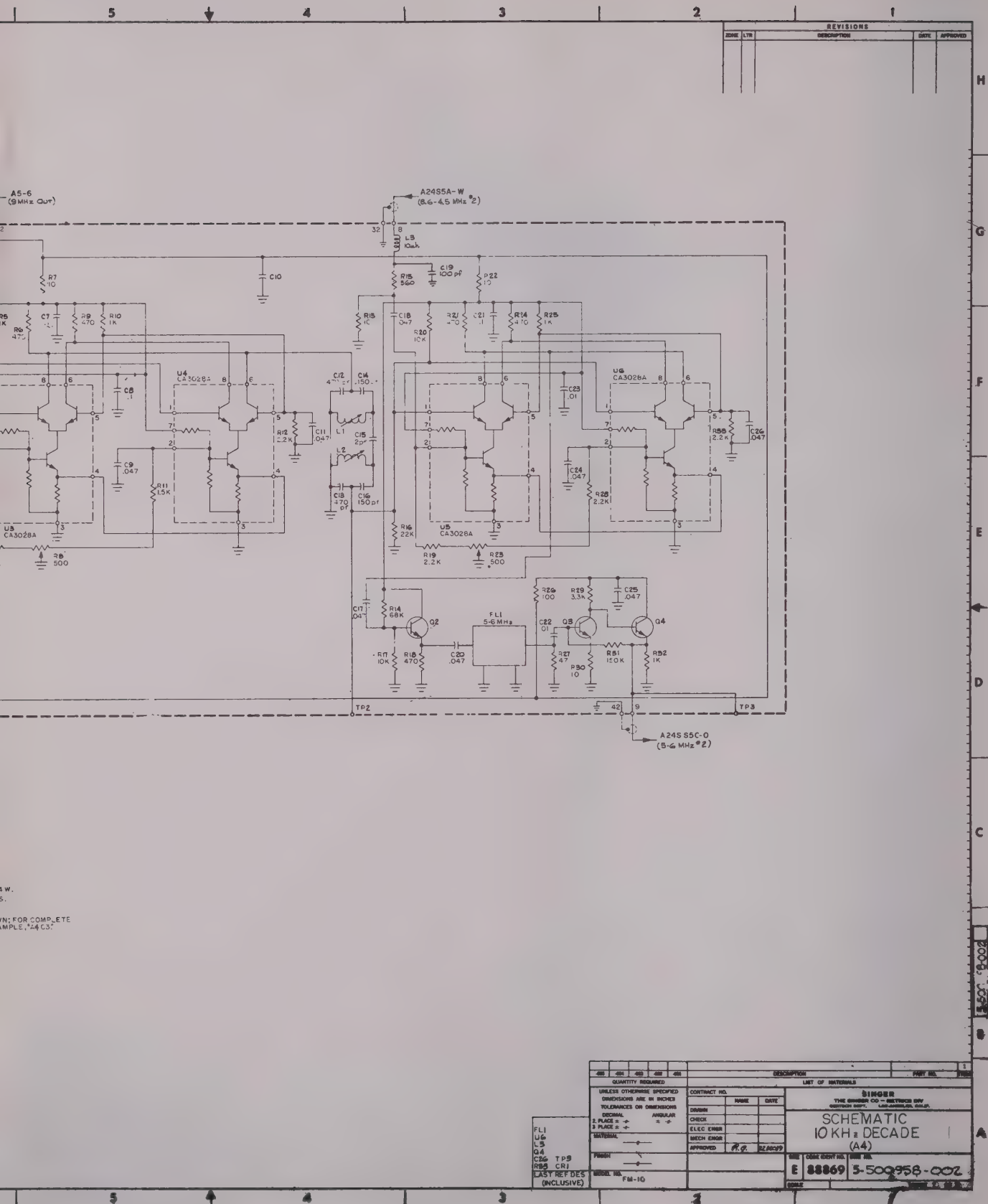
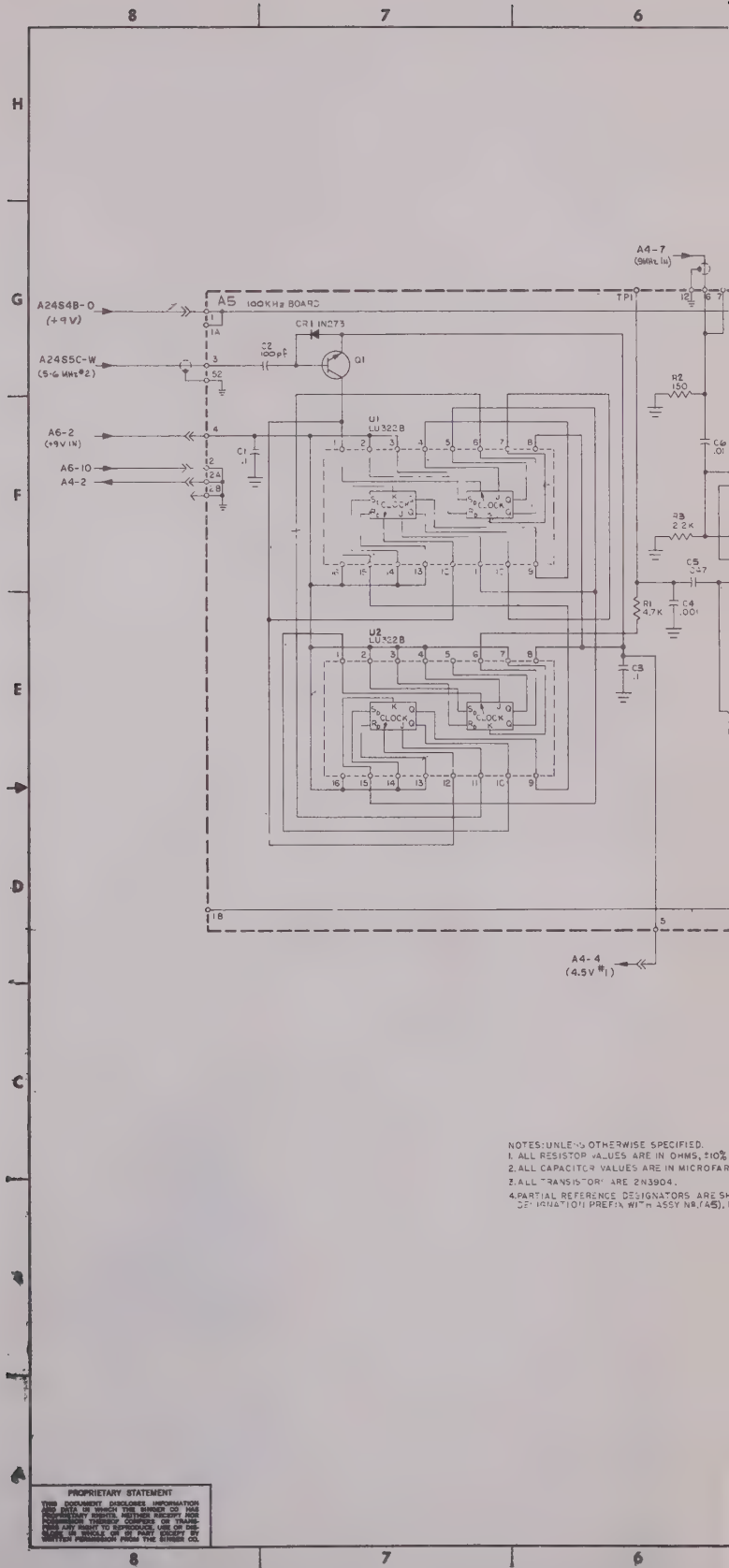
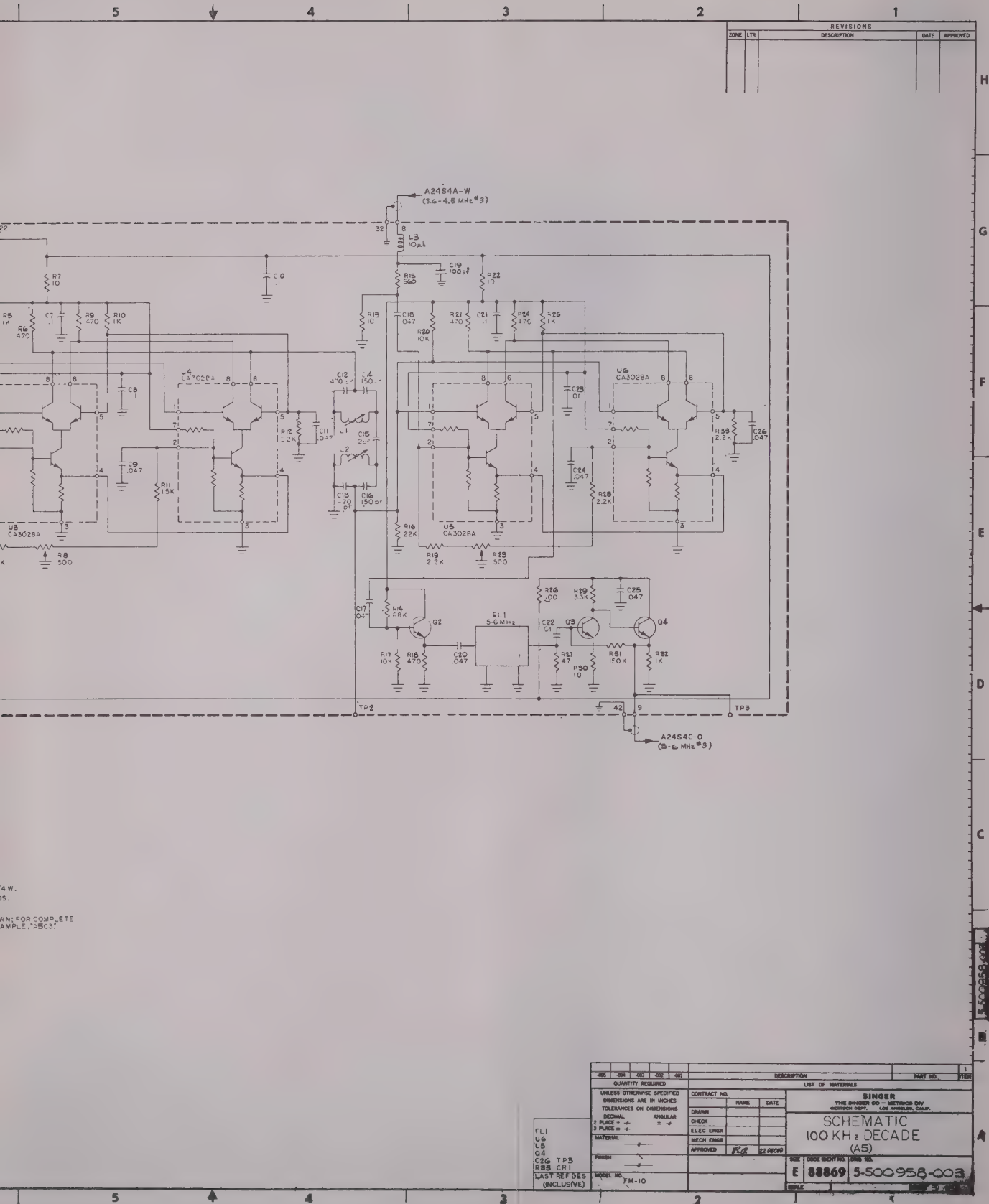


Figure 5-7. 10KHz Decade (A4), Schematic Diagram

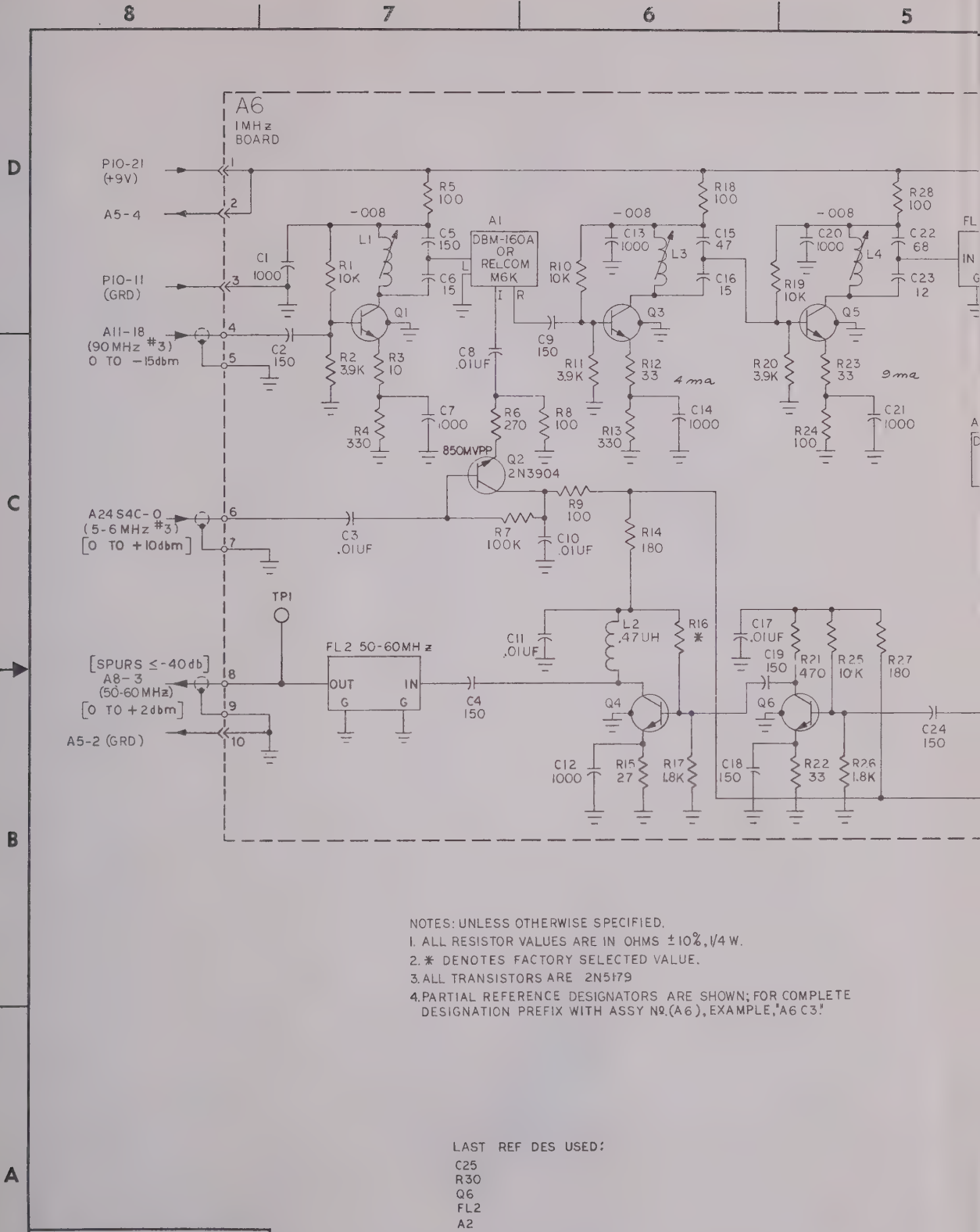




5-8. 100KHz Decade (A5), Schematic Diagram

QUANTITY REQUIRED		LIST OF MATERIALS		CONTRACT NO.		NAME		DATE	
UNLESS OTHERWISE SPECIFIED		DESCRIPTION	PART NO.	QUANTITY					
DIMENSIONS ARE IN INCHES									
TOLERANCES ON DIMENSIONS									
2 PLACE ±	ANGULAR								
3 PLACE ±									
MATERIAL									
FINISH									
LAST REF DES (INCLUSIVE)									

SINGER		THE SINGER CO - METRIC DAY		ELECTRIC EQUIPMENT - USE SINGER'S NAME	
SCHEMATIC					
100 KHz DECADE					
(A5)					
SIZE	CODE	IDENT NO.	DATE		
E	88869	5-500958-003			

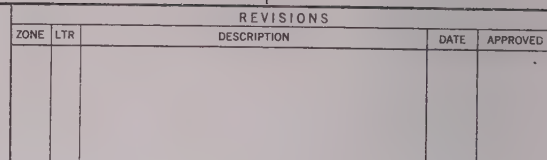


- NOTES: UNLESS OTHERWISE SPECIFIED.
1. ALL RESISTOR VALUES ARE IN OHMS $\pm 10\%$, 1/4 W.
 2. * DENOTES FACTORY SELECTED VALUE.
 3. ALL TRANSISTORS ARE 2N5179
 4. PARTIAL REFERENCE DESIGNATORS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH ASSY NO. (A6), EXAMPLE, 'A6 C3.'

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Figure 5-9. 1MHz Dec

4-500959-

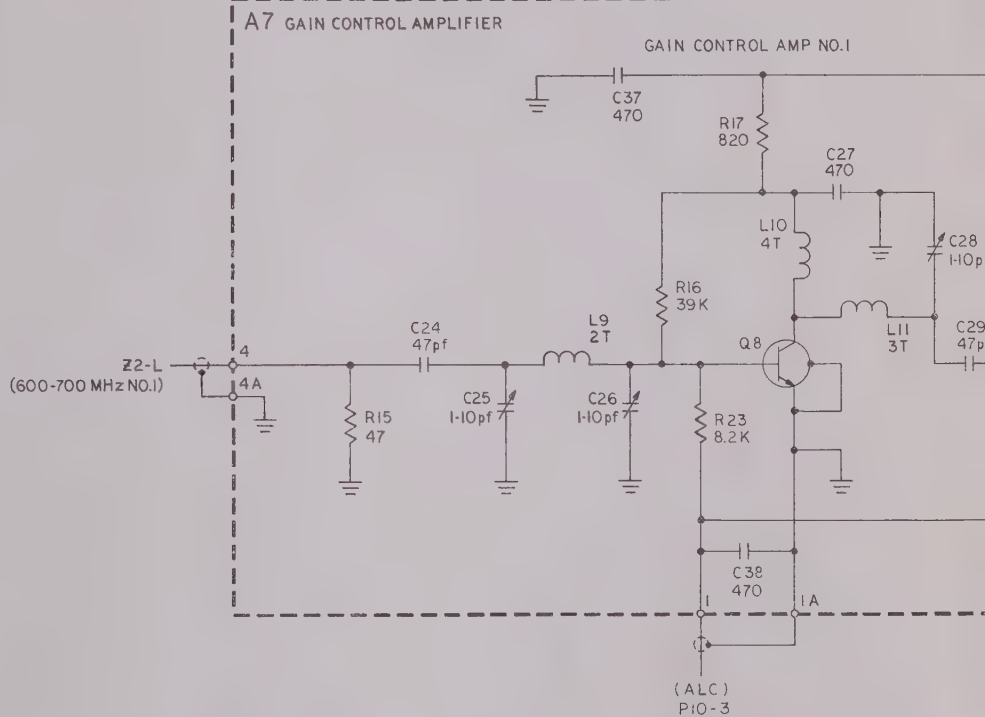
D

C

→

B

A



NOTES: UNLESS OTHERWISE SPECIFIED.

1. ALL RESISTOR VALUES ARE IN OHMS, $\pm 10\%$, 1/4W.

2. ALL CAPACITOR VALUES ARE IN MICROFARADS.

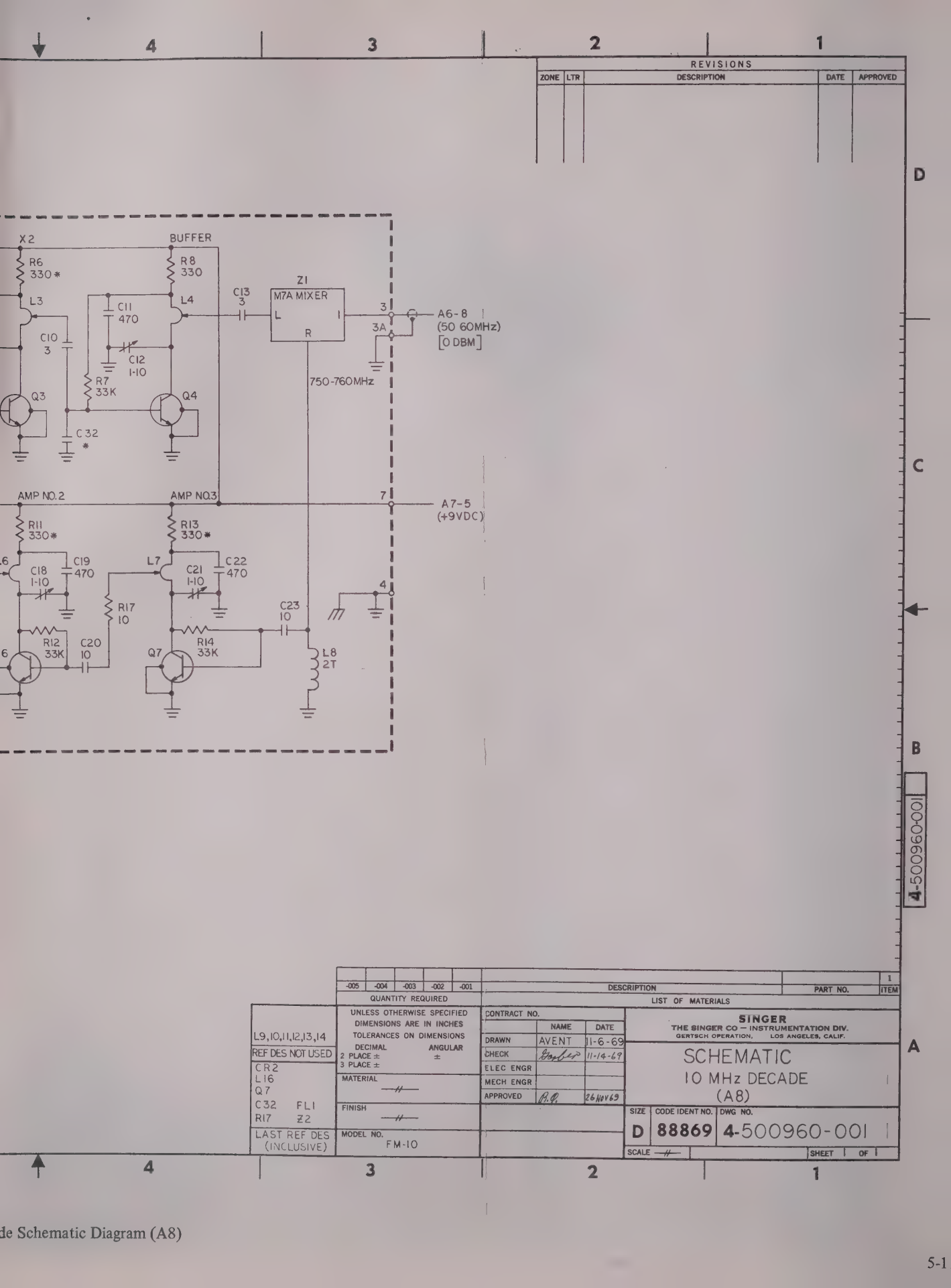
3. ALL TRANSISTORS ARE 2N5179.

4. * DENOTES FACTORY SELECTED VALUE.

5. PARTIAL REFERENCE DESIGNATORS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH ASSY NO.(A7), EXAMPLE "A7C3."

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de Schematic Diagram (A8)

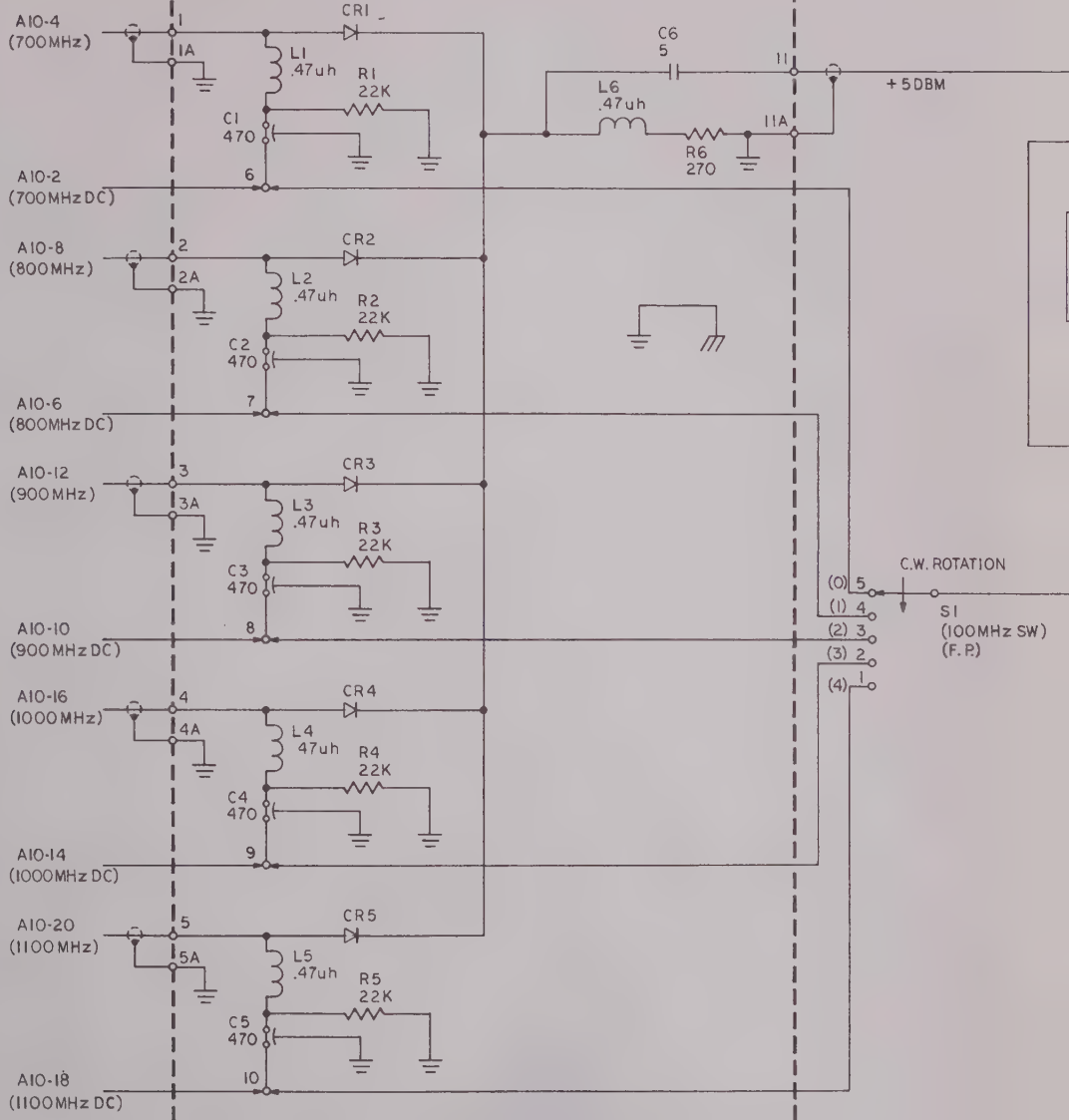
D

C

B

A

A9 DIODE SWITCH, MIXER, AND L.P. FILTER



NOTES: UNLESS OTHERWISE SPECIFIED.

1. ALL RESISTOR VALUES ARE IN OHMS, $\pm 10\%$, 1/4W.

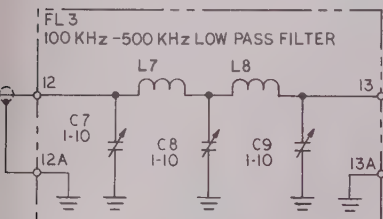
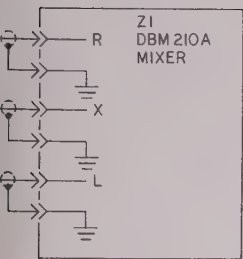
2. ALL CAPACITOR VALUES ARE IN PICOFARADS.

3. ALL DIODES ARE IN273.

4. PARTIAL REFERENCE DESIGNATORS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH ASSY NO. (A9), EXAMPLE "A9C3".

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A8-2
(600-700 MHz)
FILTER FL2

A1A4-J5
(100 KHz - 500 MHz)
[-36 DBM]

+9VDC

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

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-005	-004	-003	-002	-001										
QUANTITY REQUIRED					LIST OF MATERIALS									
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DIMENSIONS DECIMAL ANGULAR 2 PLACE ± ± 3 PLACE ± MATERIAL —H— FINISH —H— MODEL NO. FM-10					CONTRACT NO.		THE SINGER CO. — INSTRUMENTATION DIV. GERTSCH OPERATION, LOS ANGELES, CALIF.							
					NAME	DATE	SCHEMATIC DIODE SWITCH, MIXER, LOW PASS FILTER (A9)							
					DRAWN	11-3-69								
					CHECK	11-3-69								
					ELEC ENGR									
MECH ENGR														
APPROVED		11-3-69												
SIZE					CODE IDENT NO.		DWG NO.							
D					88869		4-500962-001							
SCALE					—H—		SHEET 1 OF 1							

Switch Schematic Diagram (A9)

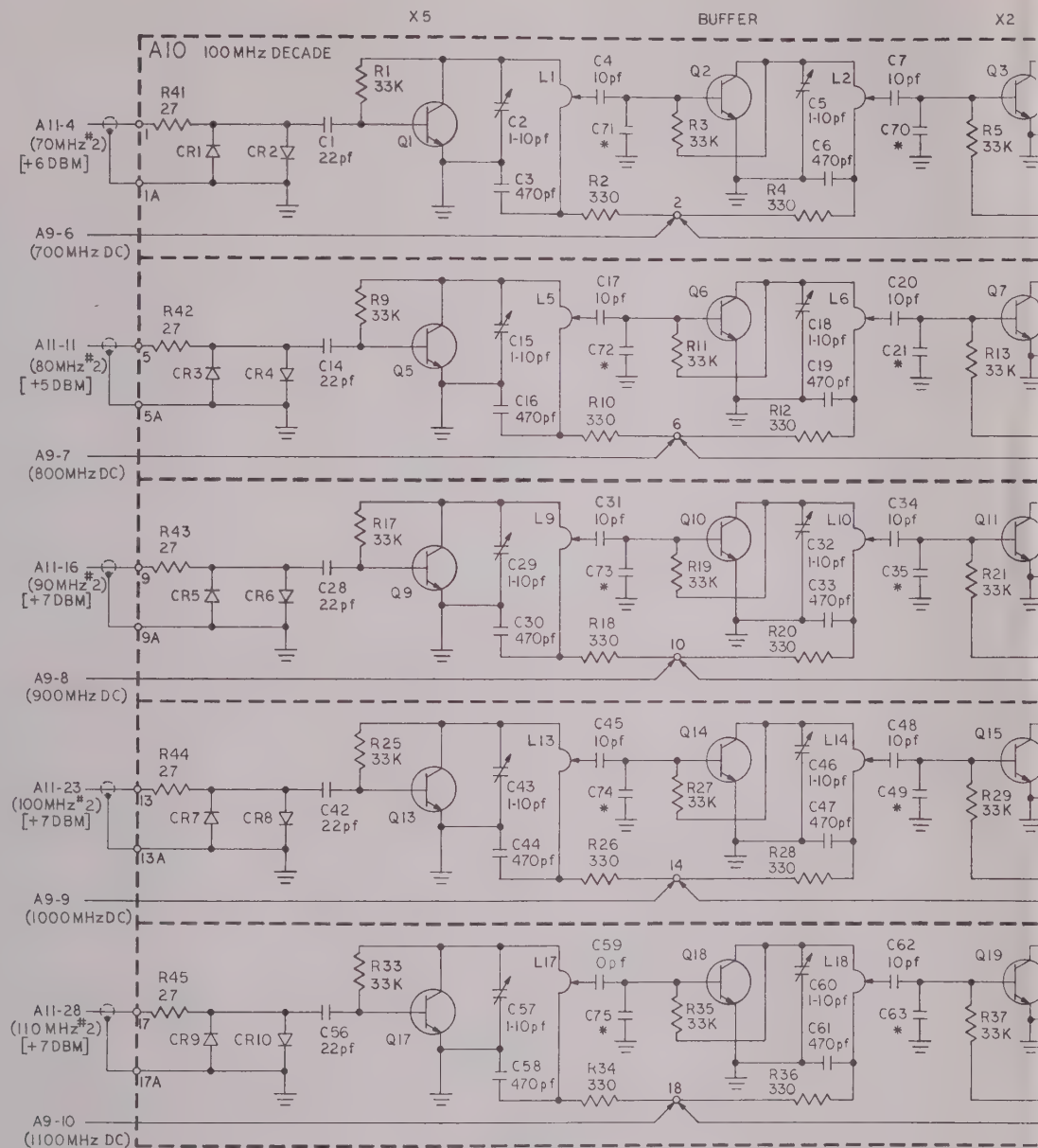
D

C

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B

A



NOTES: UNLESS OTHERWISE SPECIFIED.

1. ALL RESISTOR VALUES ARE IN OHMS, $\pm 10\%$, $1/4$ W.

2. ALL CAPACITOR VALUES ARE IN MICROFARADS.

3. ALL TRANSISTORS ARE 2N5179.

4. ALL DIODES ARE 1N273.

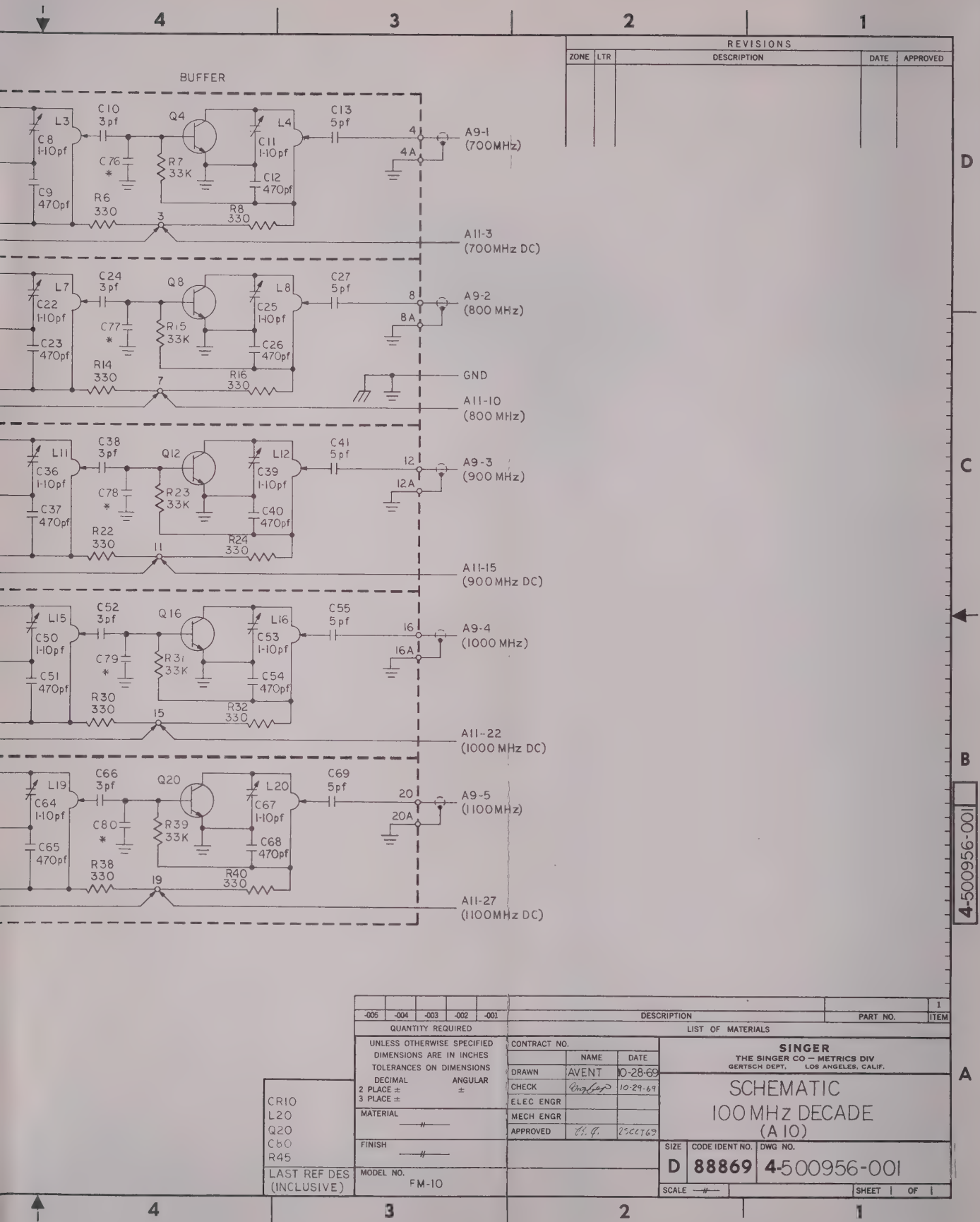
5. * DENOTES FACTORY SELECTED VALUE.

6. PARTIAL REFERENCE DESIGNATORS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH ASSY NO. (A10), EXAMPLE "A10C3".

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Figure 5-13. 100MHz



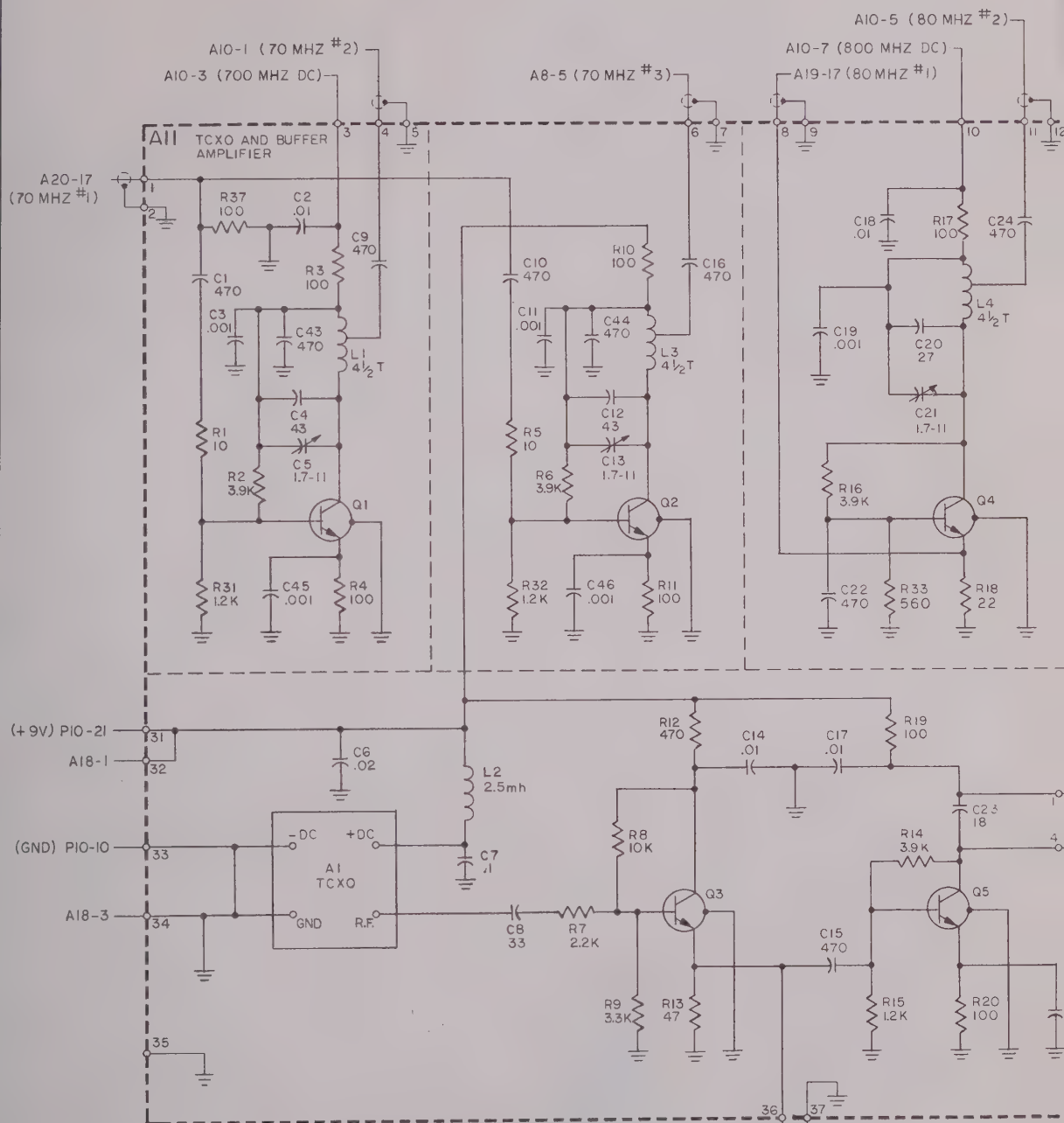
General Schematic Diagram (A10)

D

C

B

A



NOTES: UNLESS OTHERWISE SPECIFIED.

1. ALL RESISTOR VALUES ARE IN OHMS, $\pm 10\%$, $1/4$ W.

2. ALL CAPACITOR VALUES ARE IN MICROFARADS.

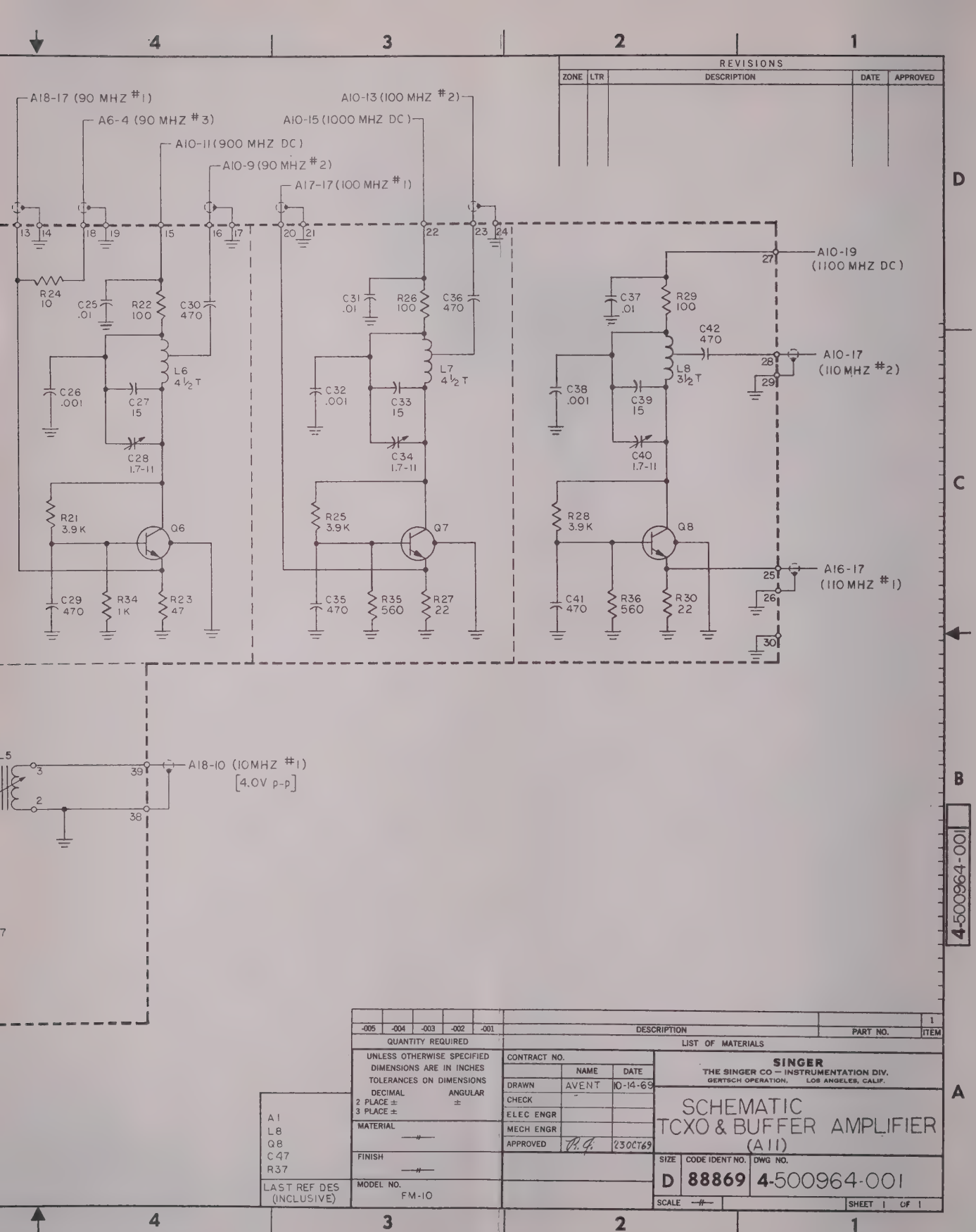
3. ALL TRANSISTORS ARE 2N5179.

4. PARTIAL REFERENCE DESIGNATORS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH ASSY NO.(A11), EXAMPLE "A11C3".

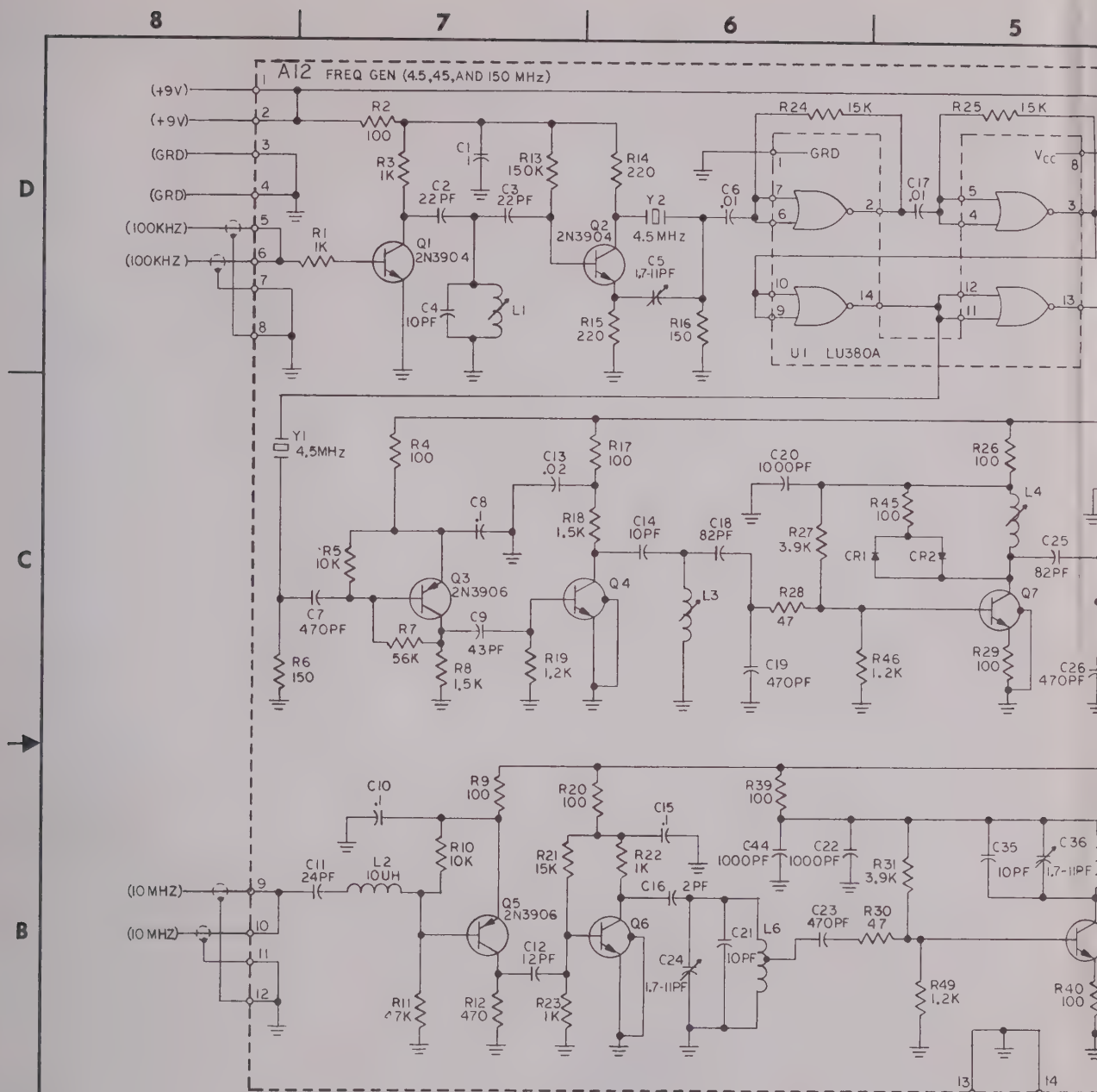
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Figure 5-14. TCXO and Buffer A



Amplifier, General Schematic Diagram (A11)



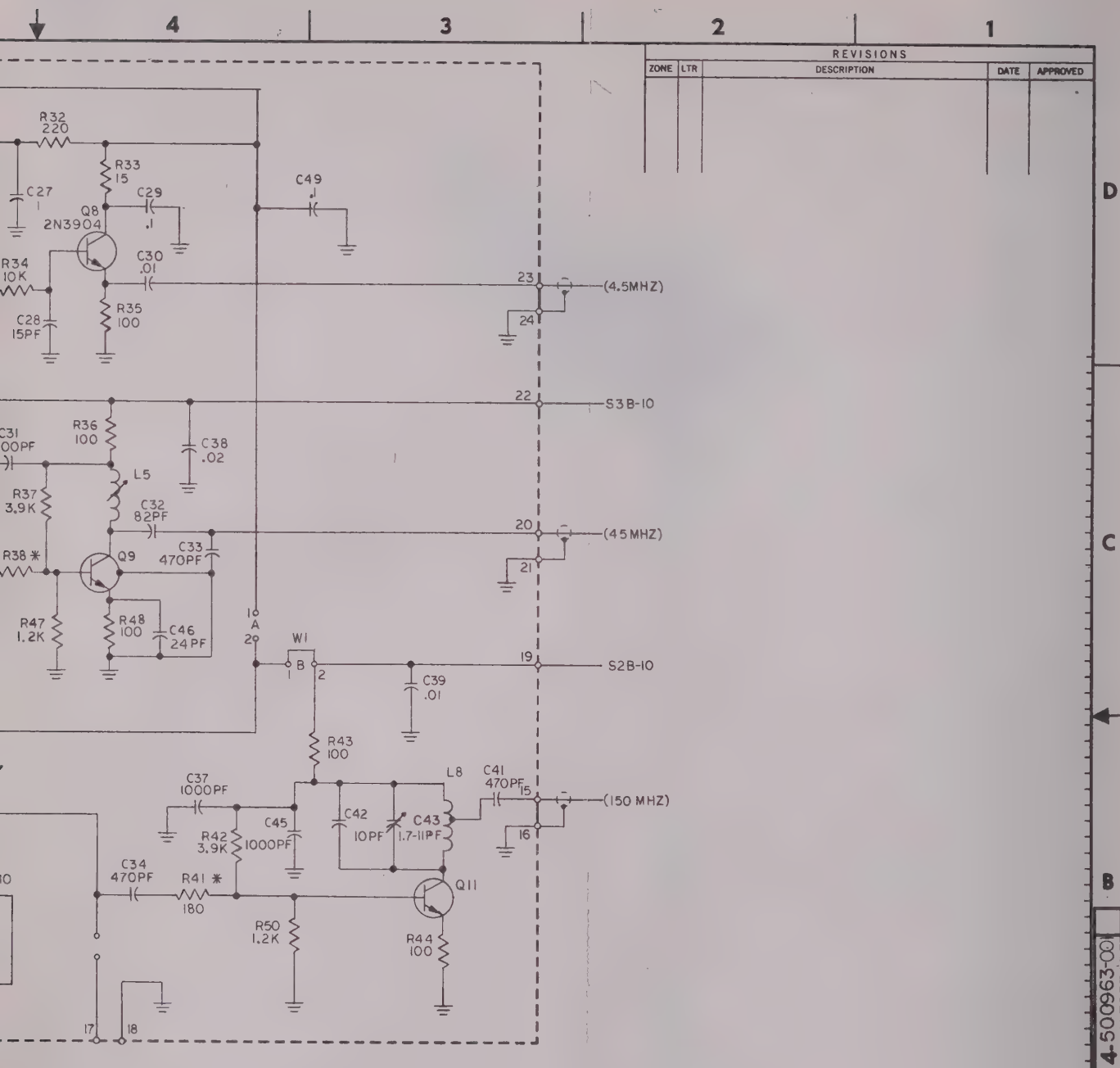
NOTES: UNLESS OTHERWISE SPECIFIED;

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH ASSY NO (A12), EXAMPLE A12R1.
2. ALL RESISTORS VALUES ARE IN OHMS, $\pm 10\%$, 1/4 W.
3. ALL CAPACITORS VALUES ARE IN MICROFARADS.
4. ALL TRANSISTORS (Q) ARE 2N5179.
5. ALL DIODES (CR) ARE IN4148.
6. * DENOTES FACTORY SELECTED VALUE.

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Figure 5-15. 4.5, 45 and 1



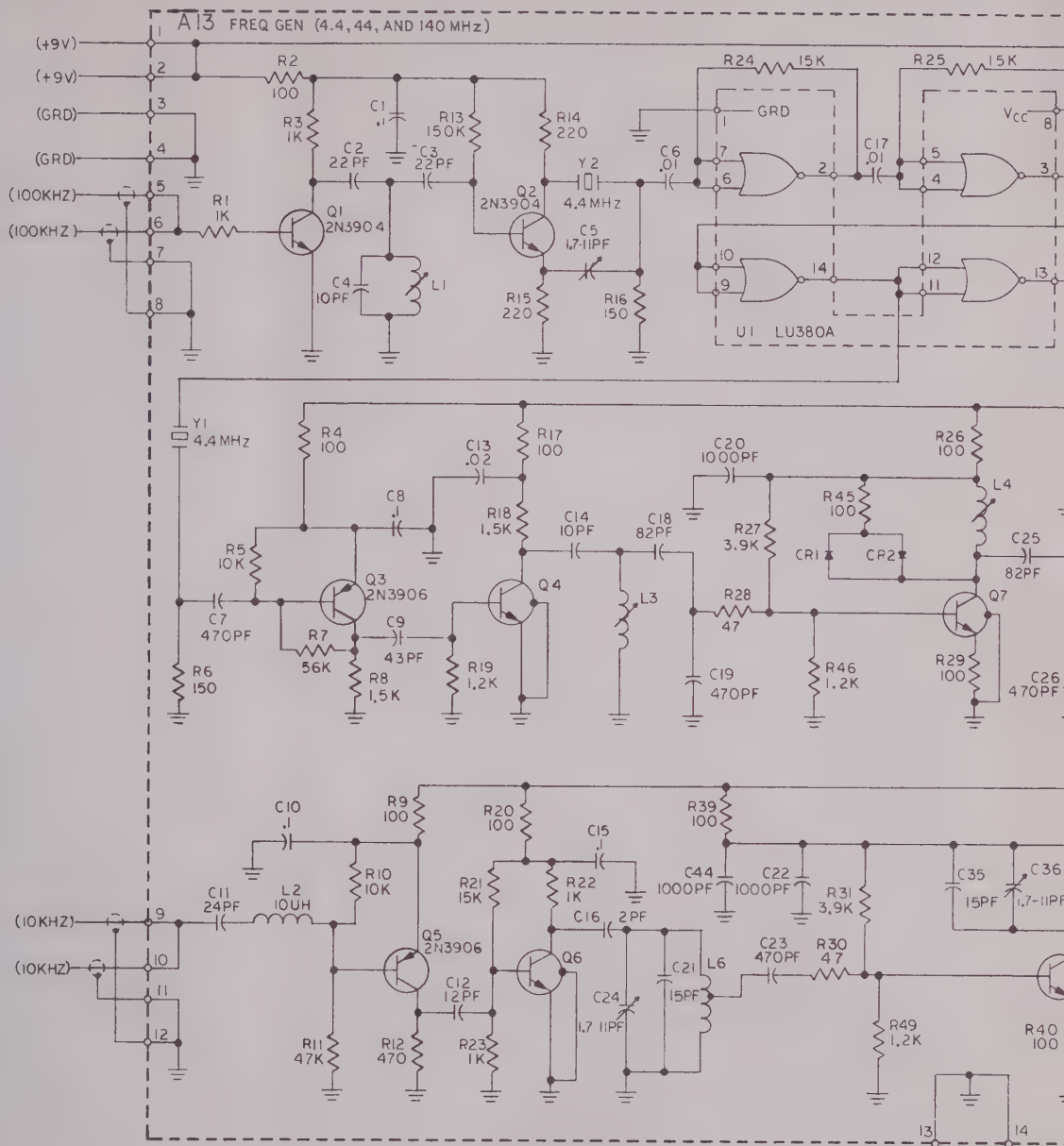
QUANTITY REQUIRED		CONTRACT NO.		LIST OF MATERIALS	
-005	-004	-003	-002	-001	DESCRIPTION
C40, C47, C48		NAME		DATE	
REF DES NOT USED		DRAWN		CHECK	
CR2		MECH ENGR		APPROVED	
L8		APPROVED		DATE	
Q11		APPROVED		DATE	
C49 Y2		APPROVED		DATE	
R50 U1		APPROVED		DATE	
LAST REF DES (INCLUSIVE)		APPROVED		DATE	
MODEL NO.		APPROVED		DATE	
FM-10		APPROVED		DATE	
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DIMENSIONS		SINGER		THE SINGER CO - METRICS DIV	
DECIMAL ANGULAR		GERTSCH DEPT. LOS ANGELES, CALIF.		SCHEMATIC	
2 PLACE ± ~		APPROVED		FREQ GEN	
3 PLACE ± ~		APPROVED		(A12)	
MATERIAL		APPROVED		APPROVED	
FINISH		APPROVED		APPROVED	
SIZE		CODE IDENT NO.		DWG NO.	
D		88869		4-500963-001	
SCALE ~		SHEET		OF 10	

D

C

B

A

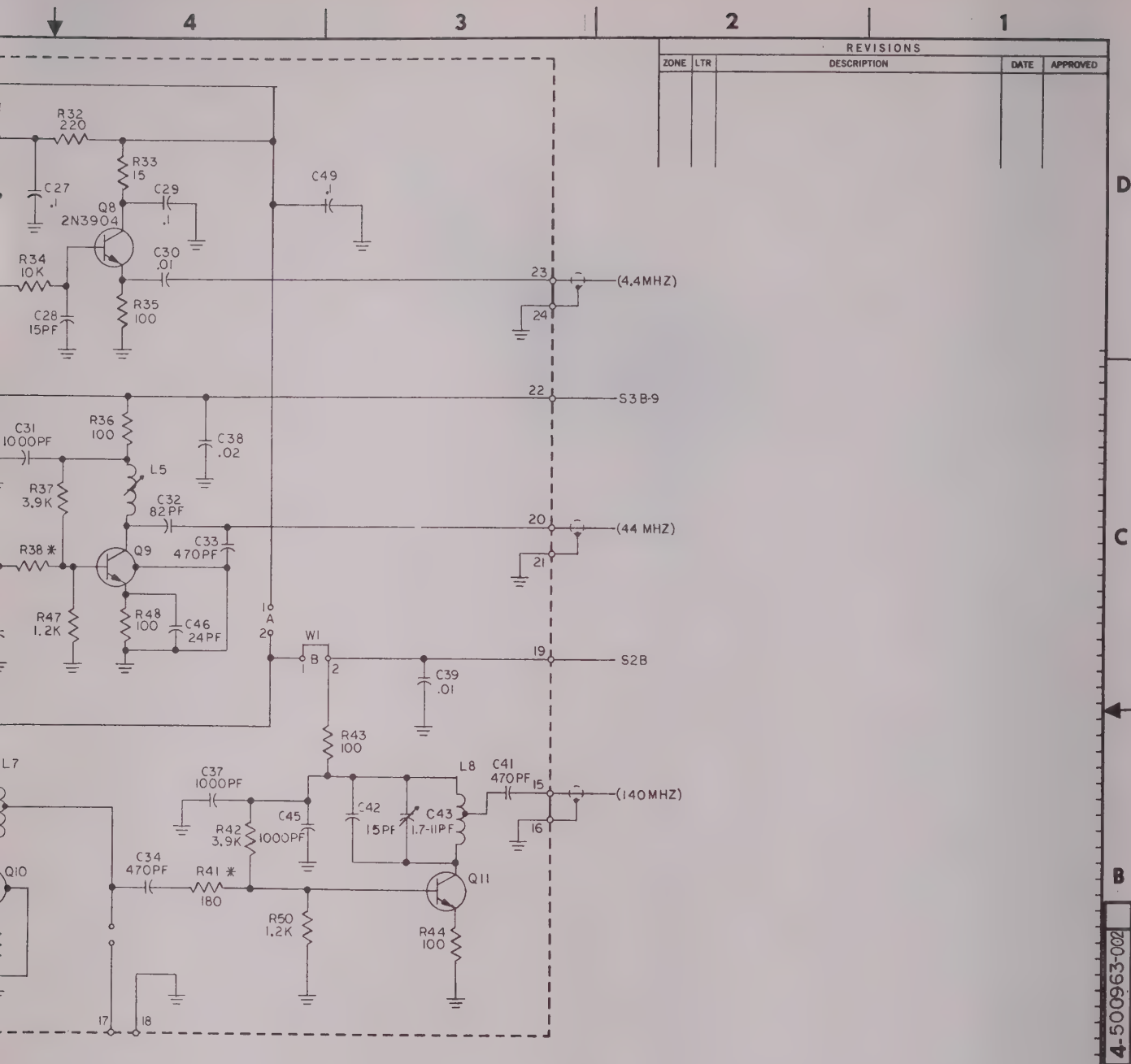


NOTES: UNLESS OTHERWISE SPECIFIED;

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH ASSY NO (A13), EXAMPLE A13R1.
2. ALL RESISTORS VALUES ARE IN OHMS, $\pm 10\%$, 1/4W.
3. ALL CAPACITORS VALUES ARE IN MICROFARADS.
4. ALL TRANSISTORS (Q) ARE 2N5179.
5. ALL D.C.DES (CR) ARE IN 4148.
6. * DENOTES FACTORY SELECTED VALUE.

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REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

D
C
B
4-500963-002

-005		-004		-003		-002		-001		DESCRIPTION		PART NO.		1																	
QUANTITY REQUIRED										LIST OF MATERIALS																					
C40, C47, C48 REF DES NOT USED CR2 L8 Q11 C49 Y2 R50 U1 LAST REF DES (INCLUSIVE)										UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DIMENSIONS DECIMAL 2 PLACE ± ~ 3 PLACE ± ~ MATERIAL FINISH MODEL NO. FM-10										CONTRACT NO. NAME DATE DRAWN CHECK ELEC ENGR MECH ENGR APPROVED						SINGER THE SINGER CO - METRICS DIV GERTSCH DEPT, LOS ANGELES, CALIF. SCHEMATIC FREQ GEN (A13)					
SIZE										CODE IDENT NO.										DWG NO.											
D										88869										4-500963-002											
SCALE ~										SHEET 2 OF 10																					

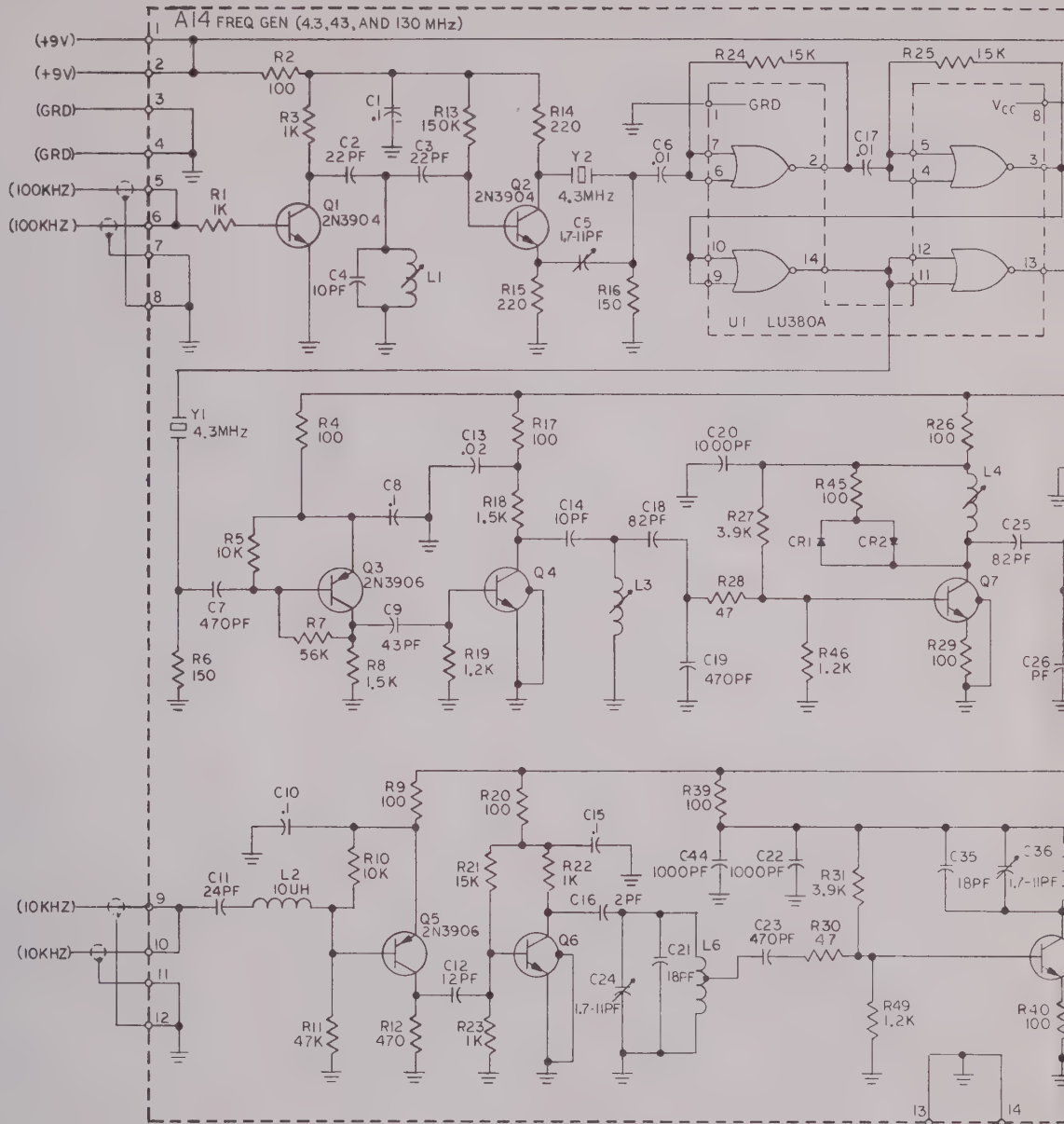
MHz General Schematic Diagram (A13)

D

C

B

A

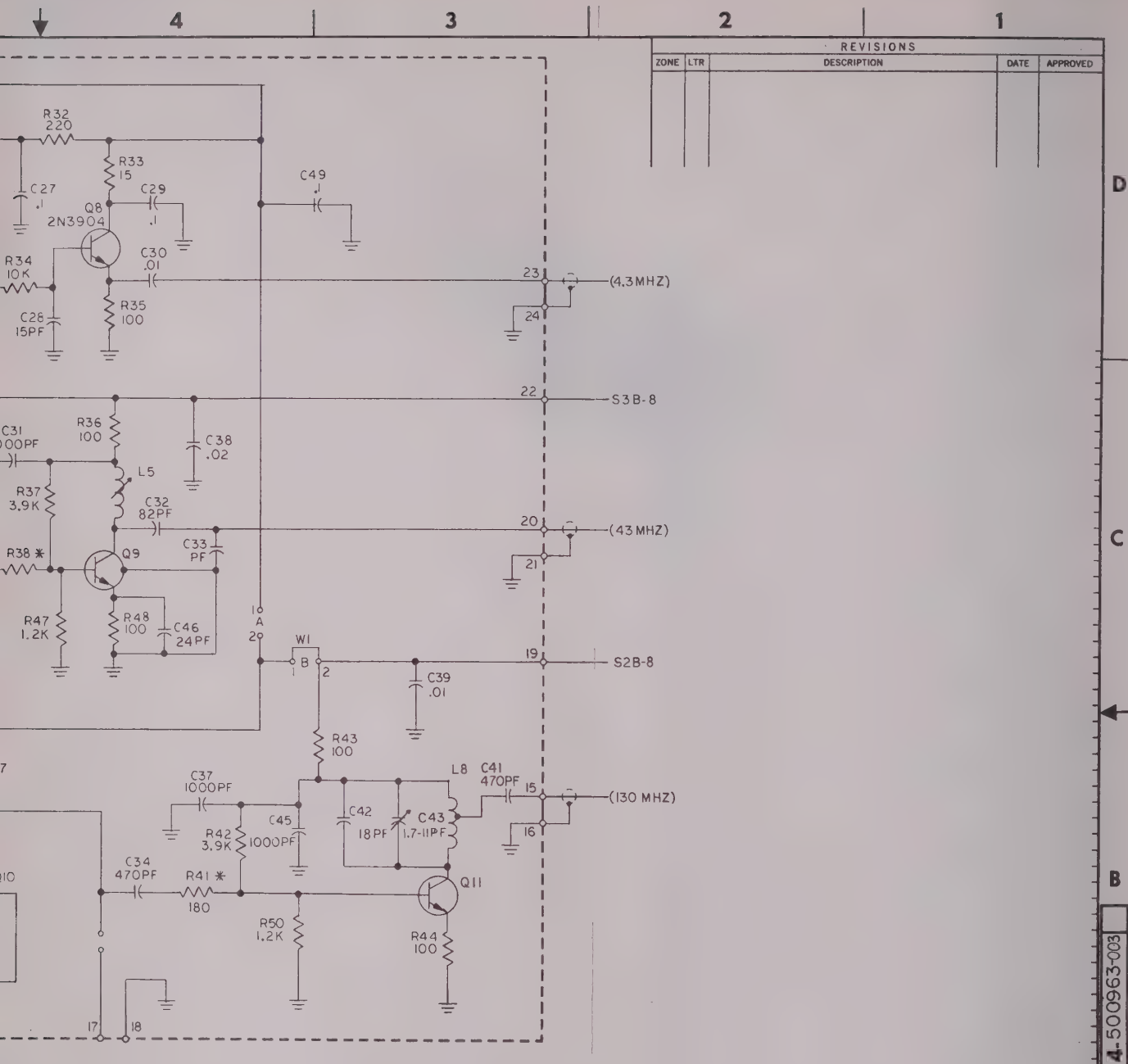


NOTES: UNLESS OTHERWISE SPECIFIED;

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH ASSY NO (A14), EXAMPLE A14R1.
2. ALL RESISTORS VALUES ARE IN OHMS, $\pm 10\%$, 1/4W.
3. ALL CAPACITORS VALUES ARE IN MICROFARADS.
4. ALL TRANSISTORS (Q) ARE 2N5179.
5. ALL DIODES (CR) ARE IN4148.
6. *DENOTES FACTORY SELECTED VALUE.

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REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

-005 -004 -003 -002 -001		DESCRIPTION		PART NO.		ITEM	
QUANTITY REQUIRED		LIST OF MATERIALS					
C40,47,48 REF DES NOT USED		CONTRACT NO.		SINGER THE SINGER CO - METRICS DIV GERTSCH DEPT. LOS ANGELES, CALIF.			
CR2 L8 Q11 C49 Y2 R50 U1		DRAWN NAME DATE		SCHEMATIC FREQ GEN (A14)			
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DIMENSIONS DECIMAL ANGULAR 2 PLACE ± ~ ± ~ 3 PLACE ± ~ ± ~ MATERIAL FINISH MODEL NO. FM-10		CHECK ELEC ENGR MECH ENGR APPROVED B.G. 10 Dec 69		SIZE CODE IDENT NO. DWG NO. D 88869 4-500963-003			
LAST REF DES (INCLUSIVE)		SCALE ~		SHEET 3 OF 10			

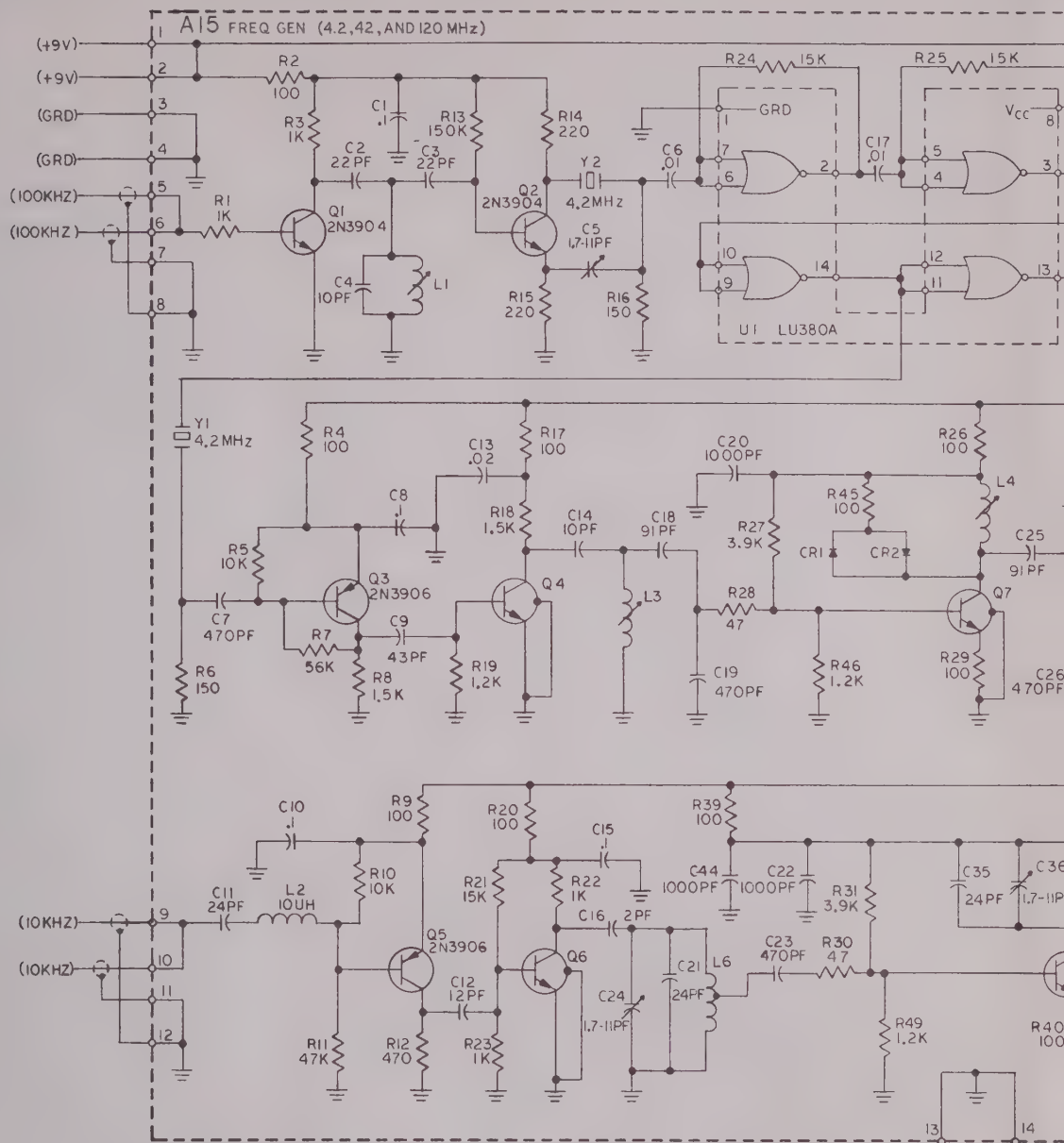
4.3 MHz General Schematic Diagram (A14)

D

C

B

A



NOTES: UNLESS OTHERWISE SPECIFIED;

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH ASSY NO (A15), EXAMPLE A15R1.

2. ALL RESISTORS VALUES ARE IN OHMS, $\pm 10\%$, 1/4W.

3. ALL CAPACITORS VALUES ARE IN MICROFARADS.

4. ALL TRANSISTORS (Q) ARE 2N5179.

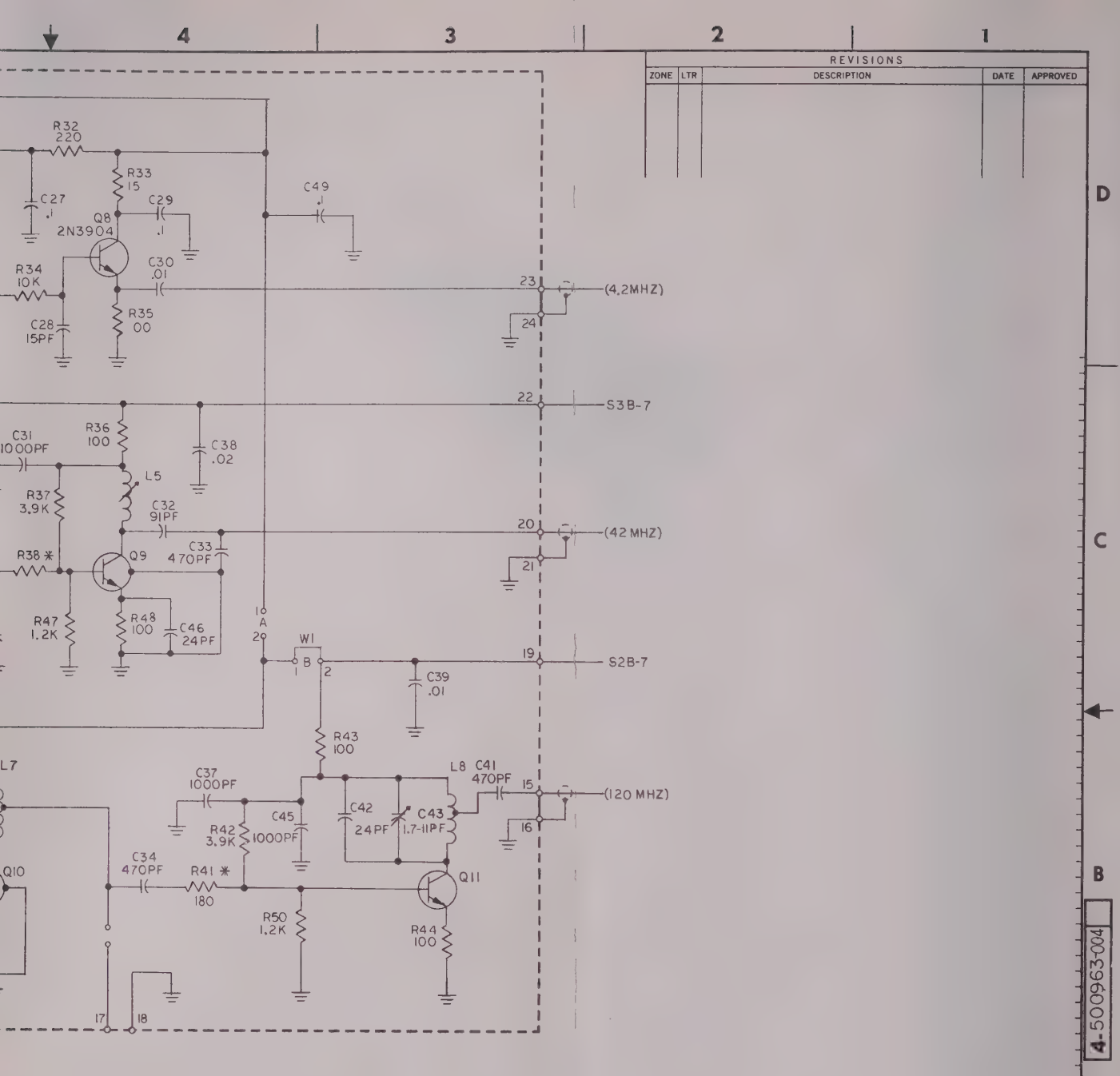
5. ALL DIODES (CR) ARE IN4148.

6. * DENOTES FACTORY SELECTED VALUE.

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Figure 5-18. 4.2, 42 and 120MHz Gener



QUANTITY REQUIRED		DESCRIPTION		PART NO.		ITEM	
-005	-004	-003	-002	-001			
C40, C47, C48		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DIMENSIONS		CONTRACT NO.			
REF DES NOT USED		DECIMAL ANGULAR		NAME DATE			
CR2		2 PLACE ± ~		DRAWN			
L8		3 PLACE ± ~		CHECK			
Q11		MATERIAL		ELEC ENGR			
C49		FINISH		MECH ENGR			
R50		MODEL NO.		APPROVED			
LAST REF DES (INCLUSIVE)		FM-10		SINGER			
				THE SINGER CO - METRICS DIV			
				GERTSCH DEPT. LOS ANGELES, CALIF.			
				SCHEMATIC			
				FREQ GEN			
				(A15)			
				SIZE CODE IDENT NO. DWG NO.			
				D 88869 4-500963-004			
				SCALE ~			
				SHEET 4 OF 10			

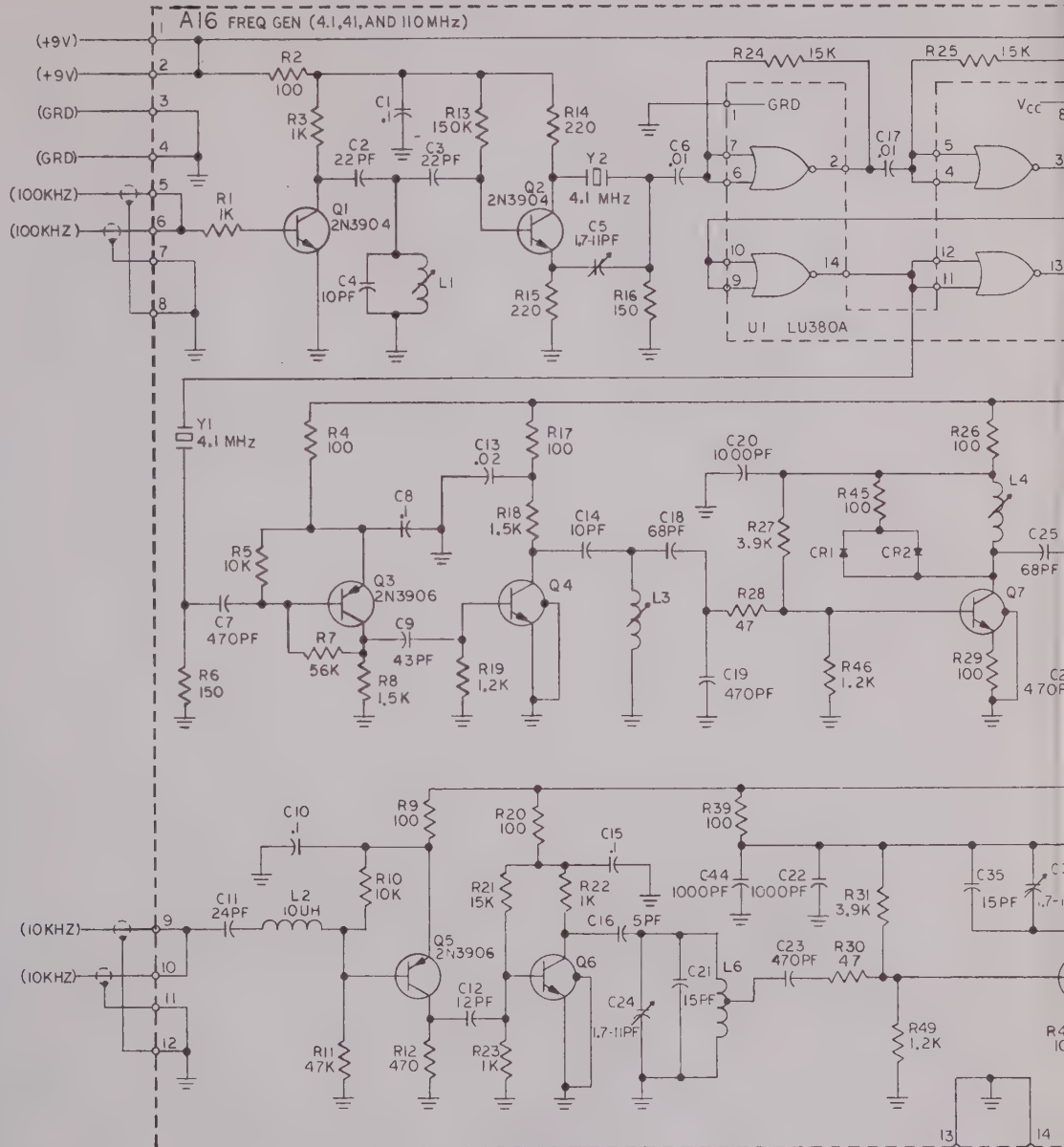
Schematic Diagram (A15)

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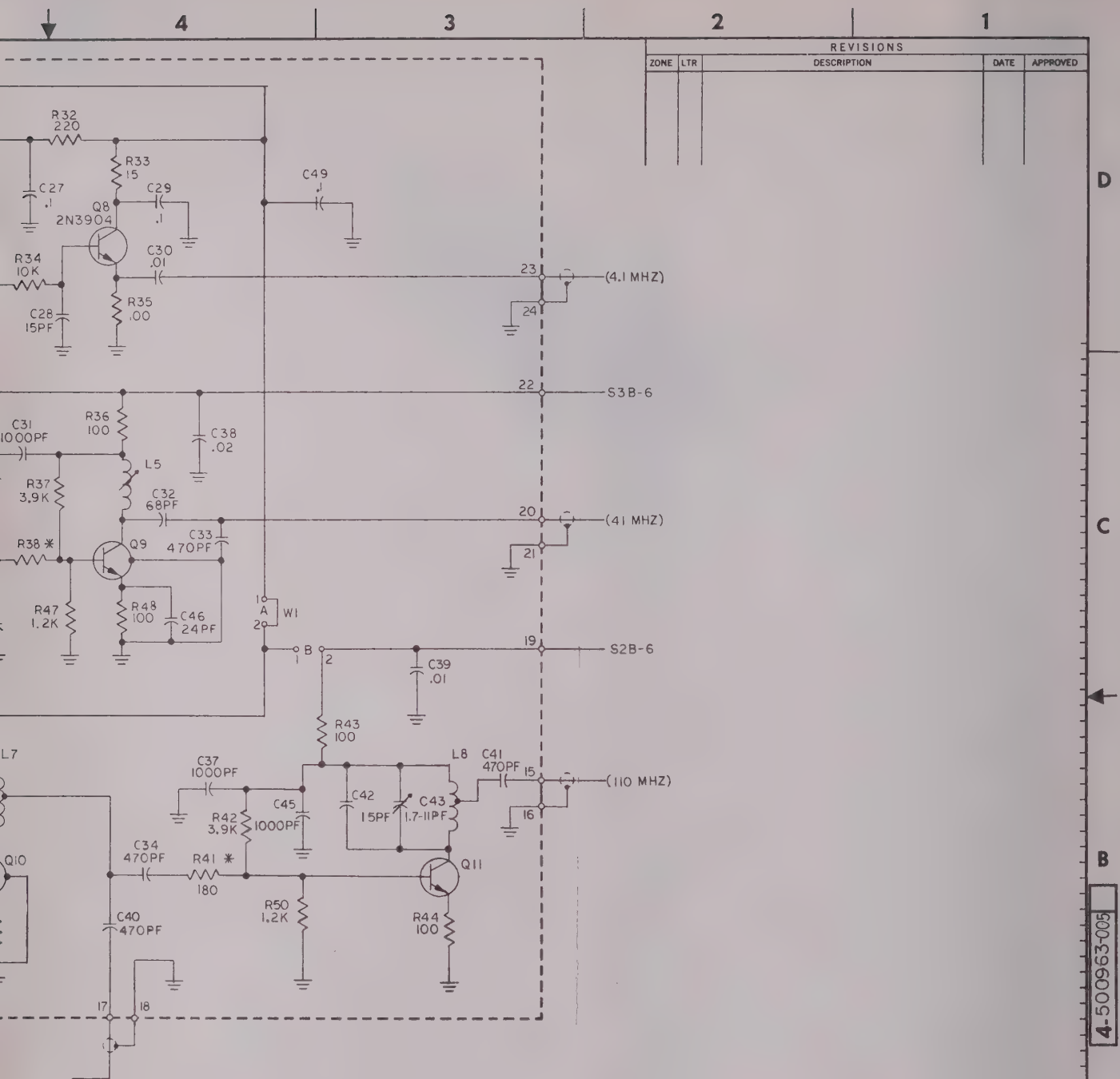


NOTES: UNLESS OTHERWISE SPECIFIED;

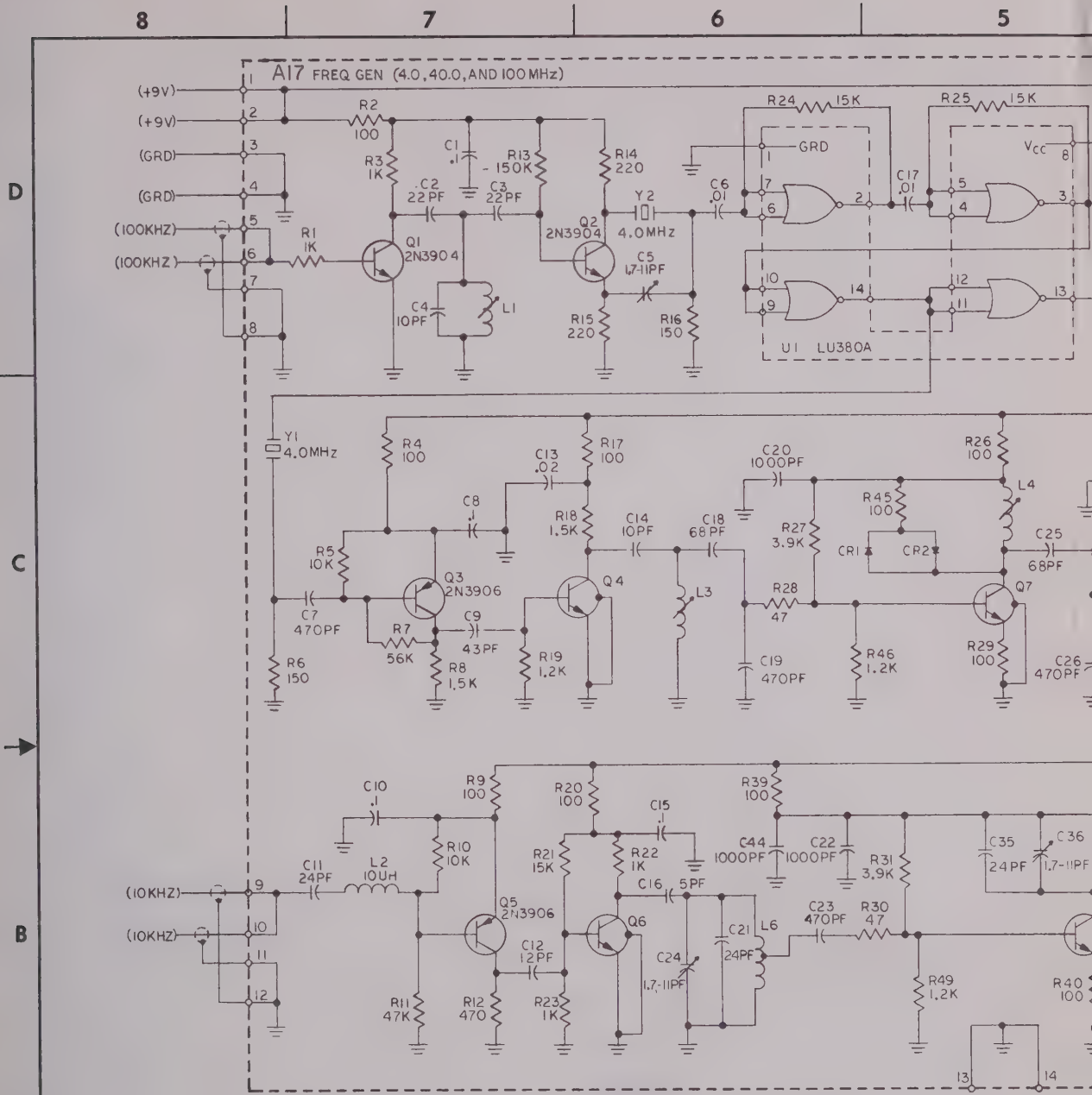
1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH ASSY NO (A16), EXAMPLE A16R1.
2. ALL RESISTORS VALUES ARE IN OHMS, $\pm 10\%$, 1/4 W.
3. ALL CAPACITORS VALUES ARE IN MICROFARADS.
4. ALL TRANSISTORS (Q) ARE 2N5179.
5. ALL DICDES (CR) ARE 1N4148.
6. *DENOTES FACTORY SELECTED VALUE.

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QUANTITY REQUIRED		DESCRIPTION		PART NO.		ITEM	
-005	-004	-003	-002	-001			
C47, 48		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DIMENSIONS		CONTRACT NO.		SINGER	
REF DES NOT USED		DECIMAL ANGULAR		DRAWN <i>[Signature]</i> DATE <i>2/17/69</i>		THE SINGER CO - METRICS DIV GERTSCH DEPT. LOS ANGELES, CALIF.	
CR2		2 PLACE ± ~		CHECK		SCHEMATIC	
L8		3 PLACE ± ~		ELEC ENGR		FREQ GEN	
Q11		MATERIAL		MECH ENGR		(A16)	
C49 Y2		FINISH		APPROVED <i>[Signature]</i> DATE <i>4/25/69</i>		SIZE CODE IDENT NO. DWG NO.	
R50 U1		MODEL NO. FM-10		D 88869		4-500963-005	
LAST REF DES (INCLUSIVE)				SCALE ~		SHEET 5 OF 10	

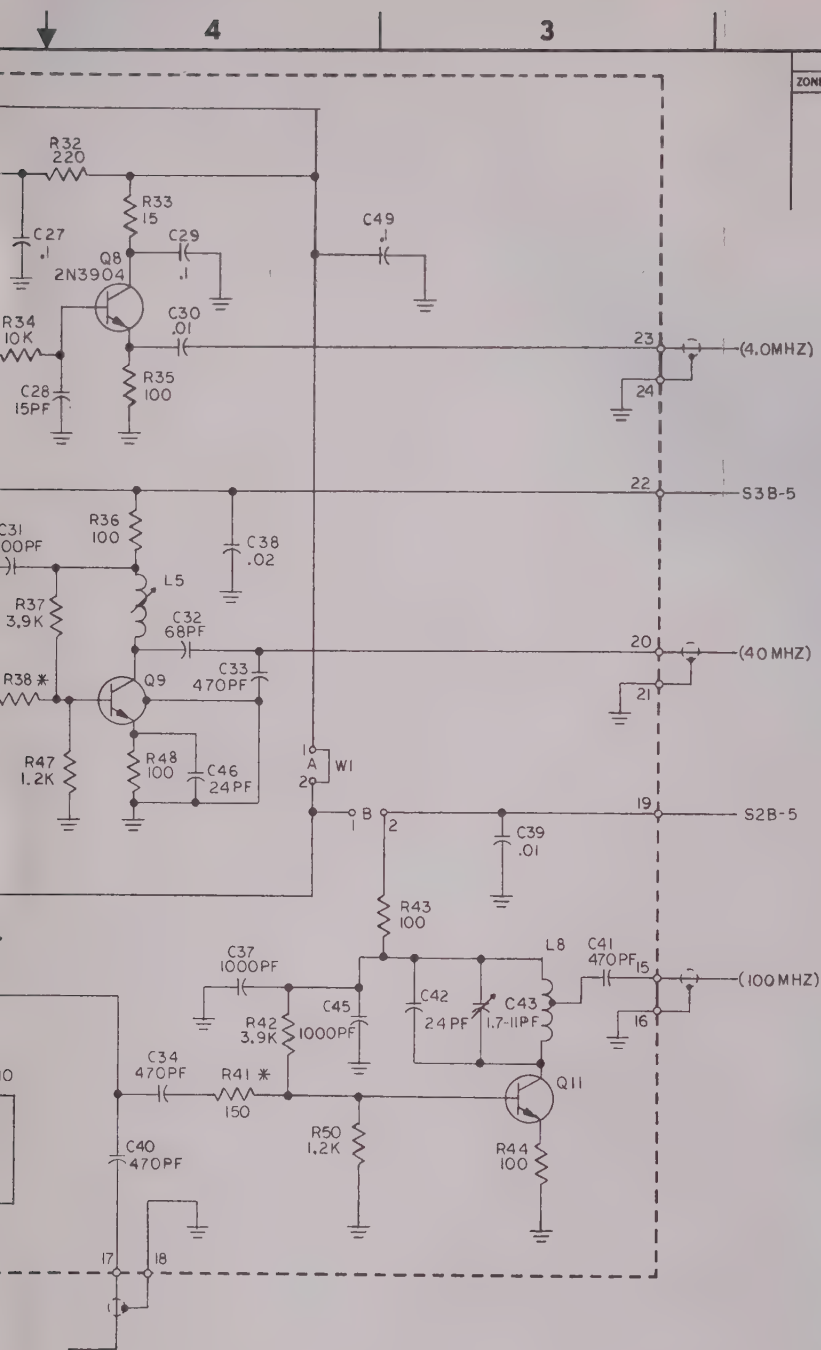


- NOTES: UNLESS OTHERWISE SPECIFIED;
1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH ASSY NO (A17), EXAMPLE A17 R1.
 2. ALL RESISTORS VALUES ARE IN OHMS, $\pm 10\%$, 1/4 W.
 3. ALL CAPACITORS VALUES ARE IN MICROFARADS.
 4. ALL TRANSISTORS (Q) ARE 2N5179.
 5. ALL DIODES (CR) ARE IN4148.
 6. * DENOTES FACTORY SELECTED VALUE.

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Figure 5-20. 4.0, 400 and



REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

D

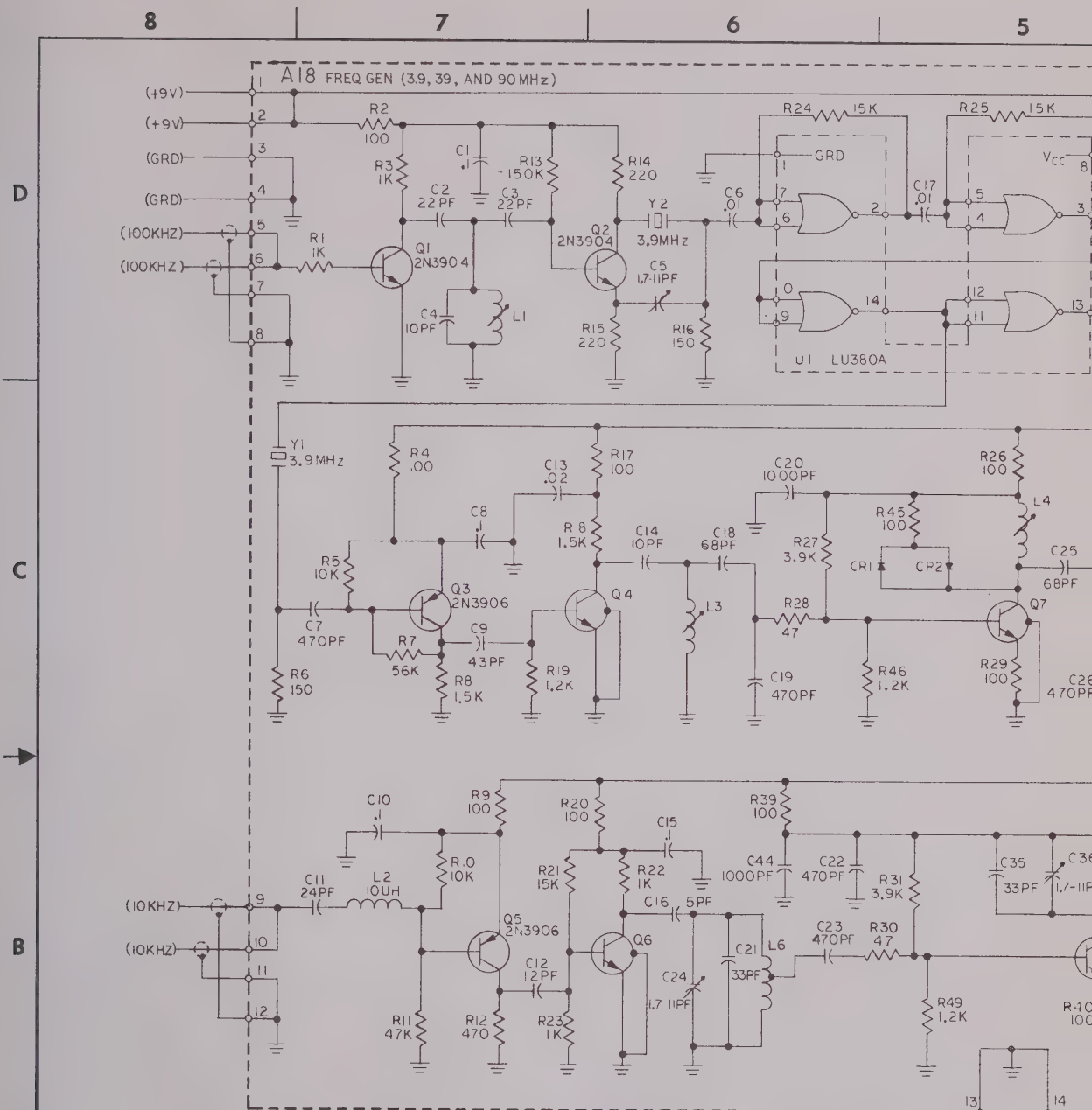
C

B

4-500963-006

A

-005 -004 -003 -002 -001		DESCRIPTION		PART NO.	1
QUANTITY REQUIRED		LIST OF MATERIALS			
C47,48 REF DES NOT USED CR2 L8 Q11 C49 Y2 R50 U1 LAST REF DES (INCLUSIVE)		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DIMENSIONS DECIMAL ANGULAR 2 PLACE ± ~ 3 PLACE ± ~ MATERIAL FINISH MODEL NO. FM-10		CONTRACT NO. NAME DATE DRAWN CHECK ELEC ENGR MECH ENGR APPROVED R.Q. 408-69	
		SINGER THE SINGER CO - METRICS DIV GERTSCH DEPT. LOS ANGELES, CALIF.		SCHEMATIC FREQ GEN (A17)	
		SIZE CODE IDENT NO. DWG NO. D 88869 4-500963-006		SCALE ~ SHEET 6 OF 10	



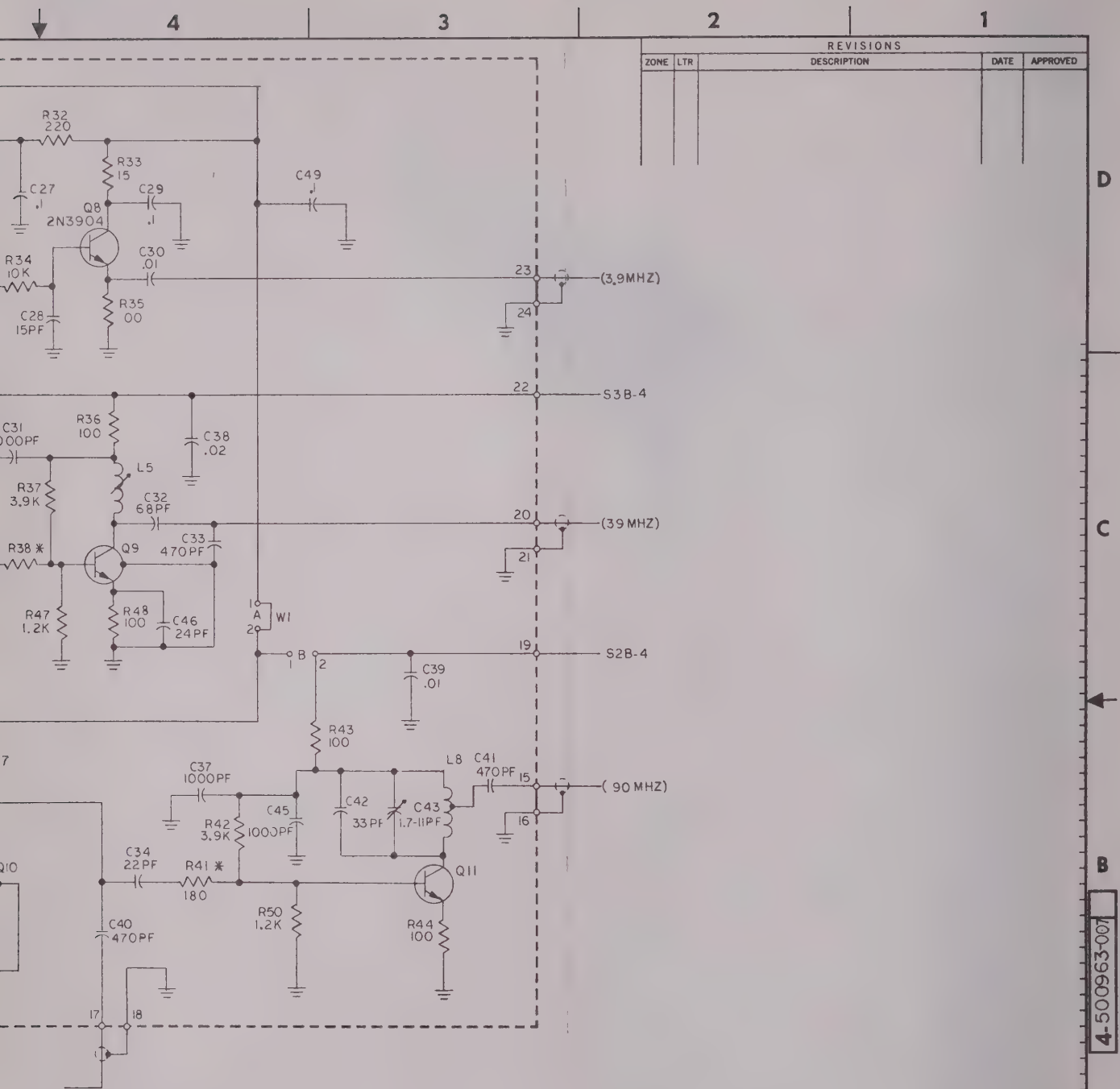
NOTES: UNLESS OTHERWISE SPECIFIED;

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH ASSY NO (A18), EXAMPLE A18 R1.
2. ALL RESISTORS VALUES ARE IN OHMS, $\pm 10\%$, 1/4 W.
3. ALL CAPACITORS VALUES ARE IN MICROFARADS.
4. ALL TRANSISTORS (Q) ARE 2N5179.
5. ALL DIODES (CR) ARE IN 4148.
6. * DENOTES FACTORY SELECTED VALUE.

PROPRIETARY STATEMENT

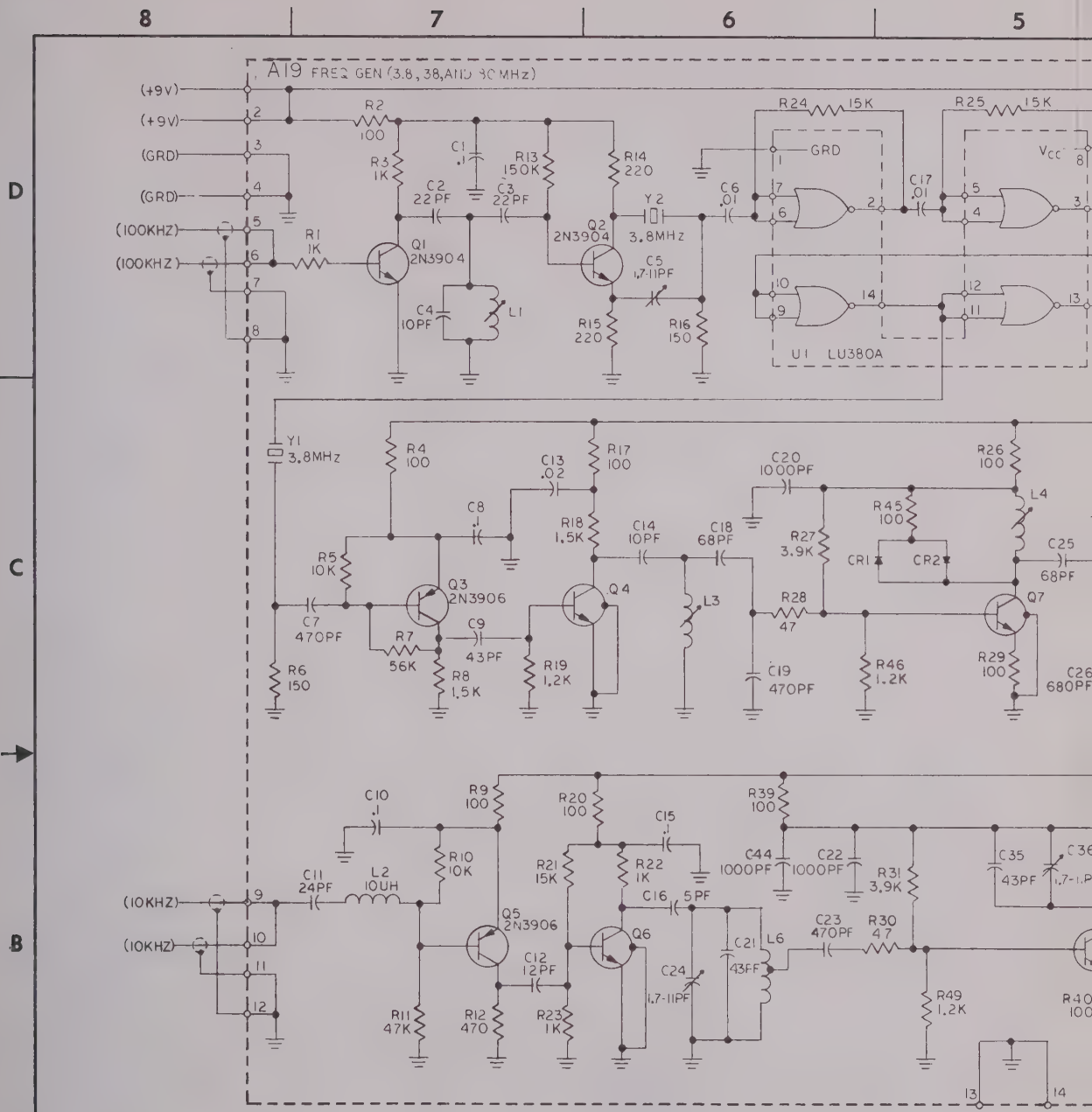
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Figure 5-21. 3.9, 39 and 90MHz Gener



QUANTITY REQUIRED					DESCRIPTION		PART NO.	ITEM
-005	-004	-003	-002	-001				
C47,48					CONTRACT NO.		1	
REF DES NOT USED					NAME		DATE	
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DIMENSIONS					DRAWN		4/17/69	
DECIMAL					CHECK			
2 PLACE ± ~					ELEC ENGR			
3 PLACE ± ~					MECH ENGR			
MATERIAL					APPROVED		R.P. 4 DEC 65	
FINISH					SIZE		CODE IDENT NO.	
LAST REF DES (INCLUSIVE)					D		88869	
MODEL NO.					DWG NO.		4-500963-0071	
FM-10					SCALE ~		SHEET 7 OF 10	

Schematic Diagram (A18)



NOTES: UNLESS OTHERWISE SPECIFIED;

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH ASSY NO (A19), EXAMPLE A19 R1.

2. ALL RESISTORS VALUES ARE IN OHMS, $\pm 10\%$, 1/4 W.

3. ALL CAPACITORS VALUES ARE IN MICROFARADS.

4. ALL TRANSISTORS (Q) ARE 2N5179.

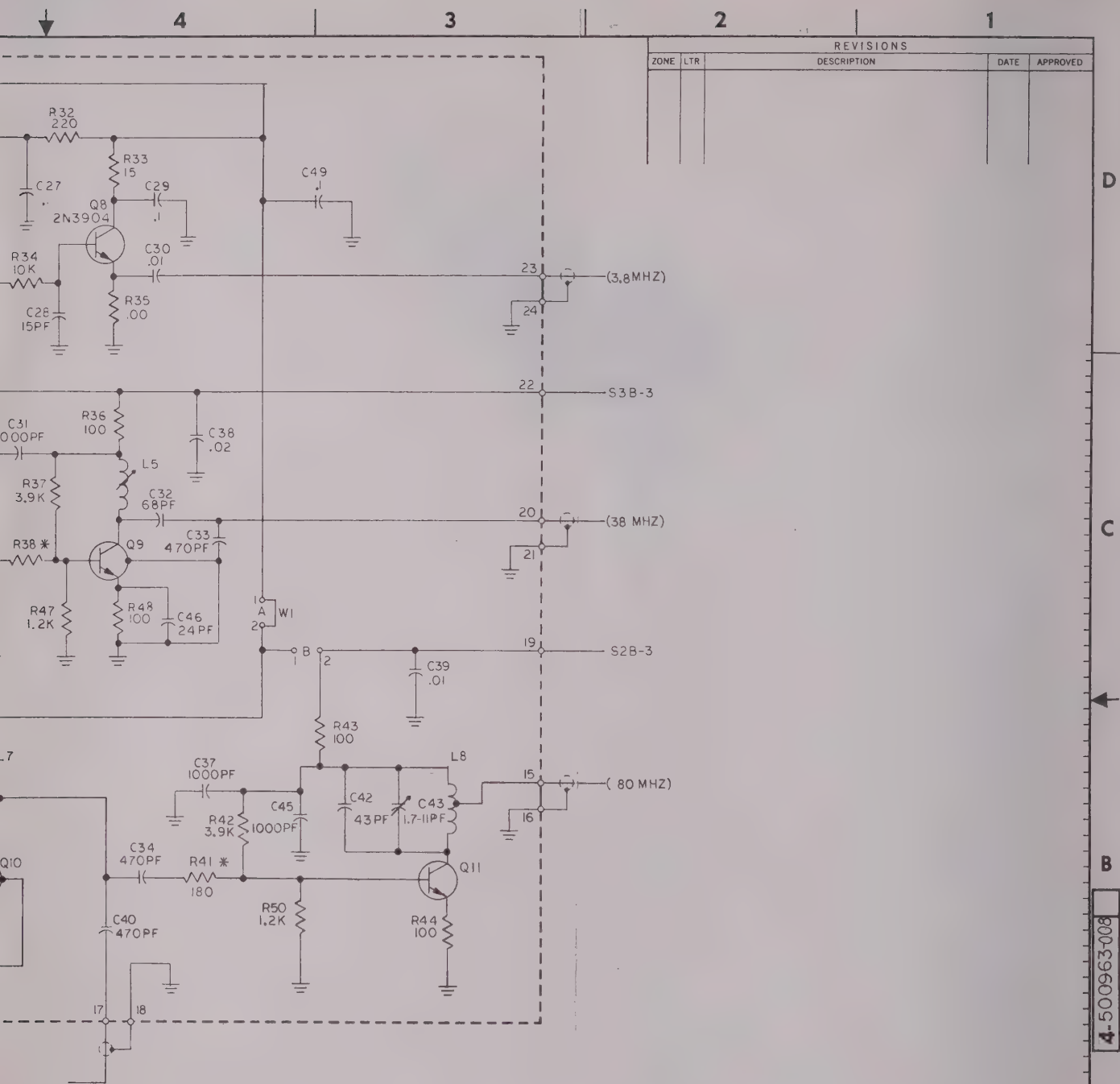
5. ALL DIODES (CR) ARE IN4148.

6. * DENOTES FACTORY SELECTED VALUE.

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Figure 5-22. 3.8, 38 and



QUANTITY REQUIRED					DESCRIPTION		PART NO.		ITEM	
-005	-004	-003	-002	-001						
C41,47,48					CONTRACT NO.		NAME		DATE	
REF DES NOT USED					DRAWN		CHECK		ELEC ENGR	
CR 2					MECH ENGR		APPROVED		B. P. 10 Dec 69	
L 8					MATERIAL		FINISH		MODEL NO.	
Q11					UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DIMENSIONS		SINGER THE SINGER CO - METRICS DIV GERTSCH DEPT. LOS ANGELES, CALIF.		SCHEMATIC FREQ GEN (A19)	
C49 Y2					2 PLACE ± ~		3 PLACE ± ~		DECIMAL ANGULAR ± ~	
R50 U1					LAST REF DES (INCLUSIVE)		FM-10		SIZE CODE IDENT NO. DWG NO.	
					D 88869		4-500963-008		SCALE ~ SHEET 8 OF 10	

0MHz General Schematic Diagram (A19)

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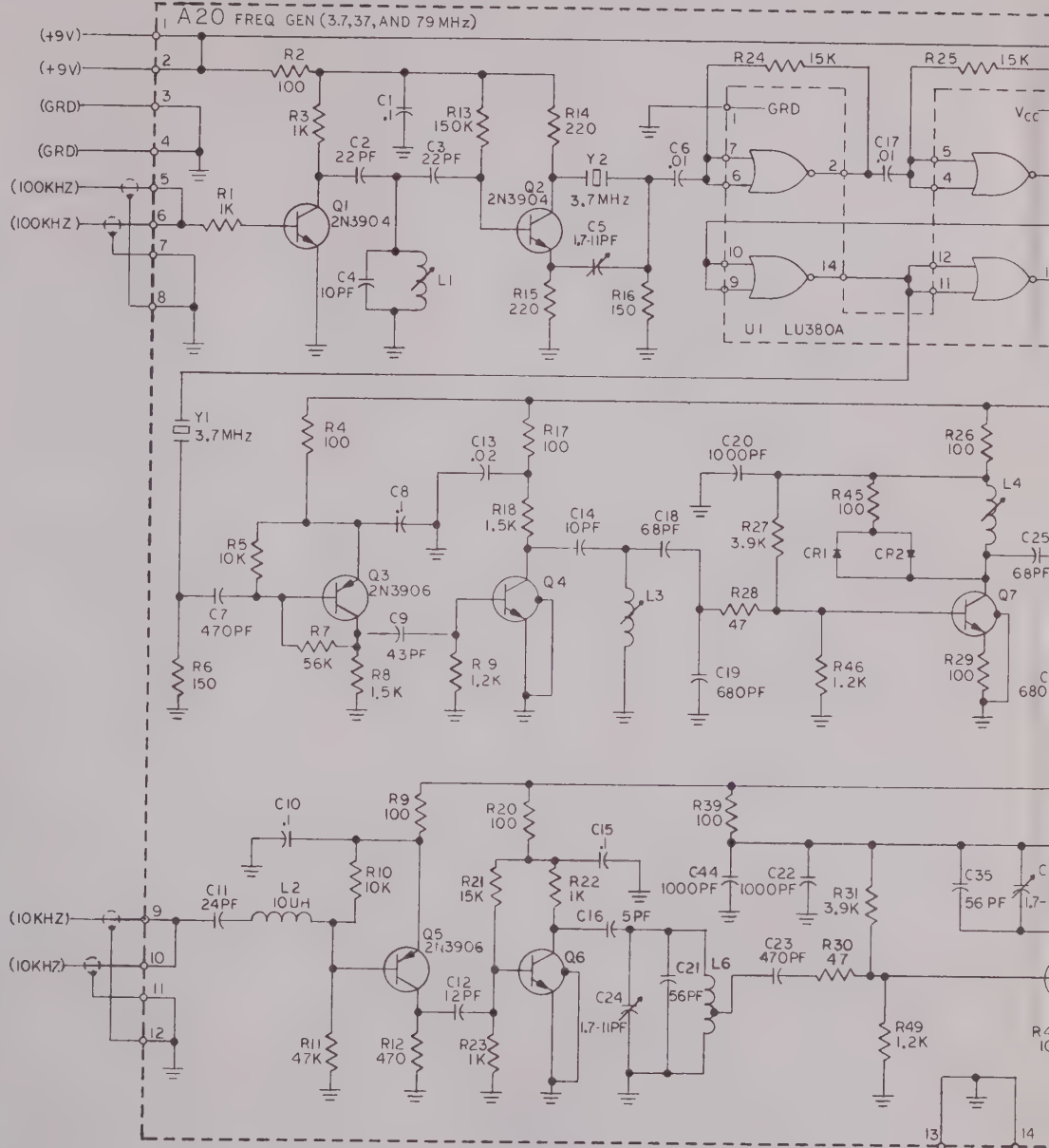
5

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NOTES: UNLESS OTHERWISE SPECIFIED;

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH ASSY NO (A20), EXAMPLE A20R1.

2. ALL RESISTORS VALUES ARE IN OHMS, $\pm 10\%$, 1/4W.

3. ALL CAPACITORS VALUES ARE IN MICROFARADS.

4. ALL TRANSISTORS (Q) ARE 2N5179.

5. ALL DICDES (CR) ARE IN 4148.

6. *DENOTES FACTORY SELECTED VALUE.

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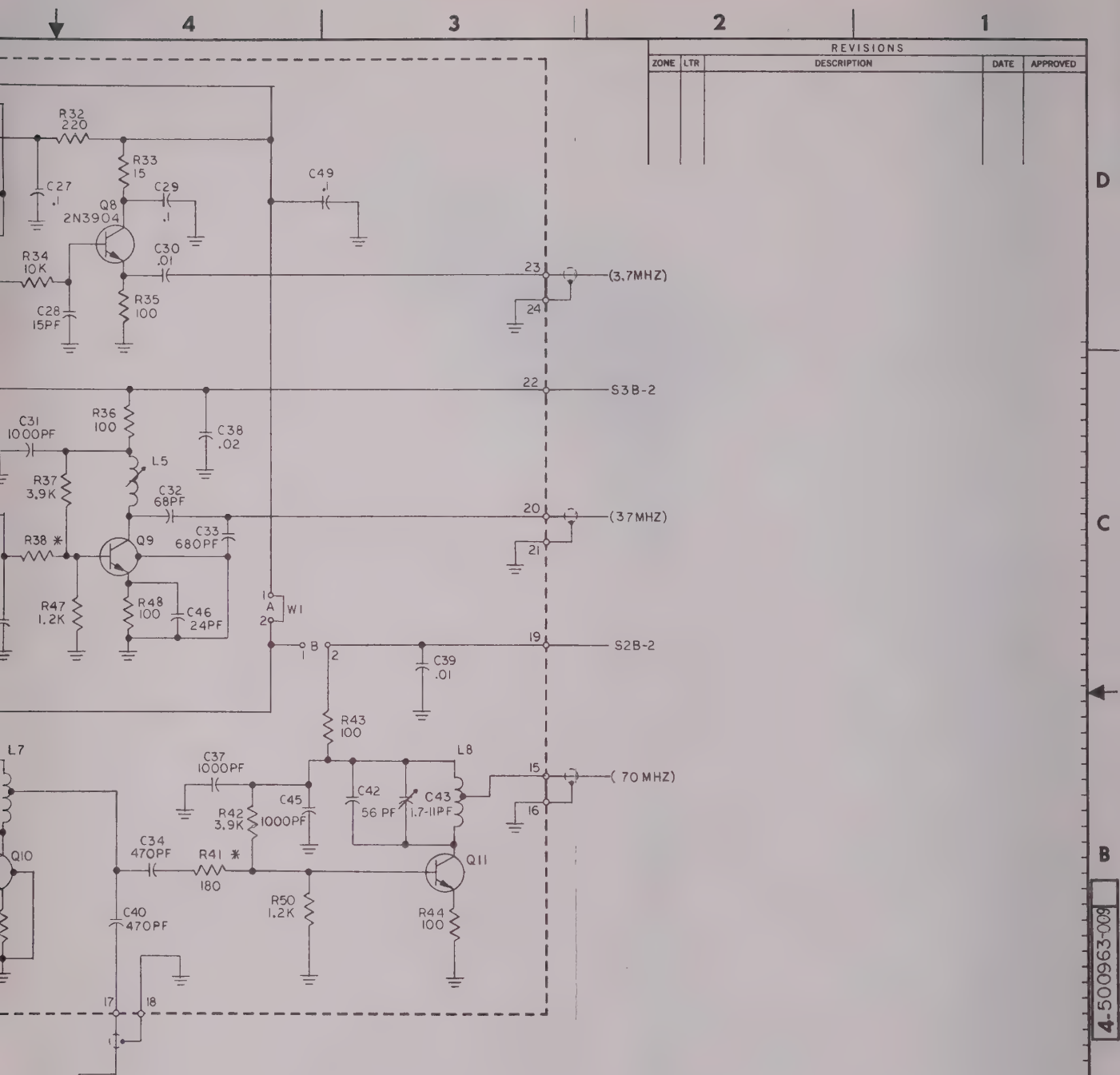
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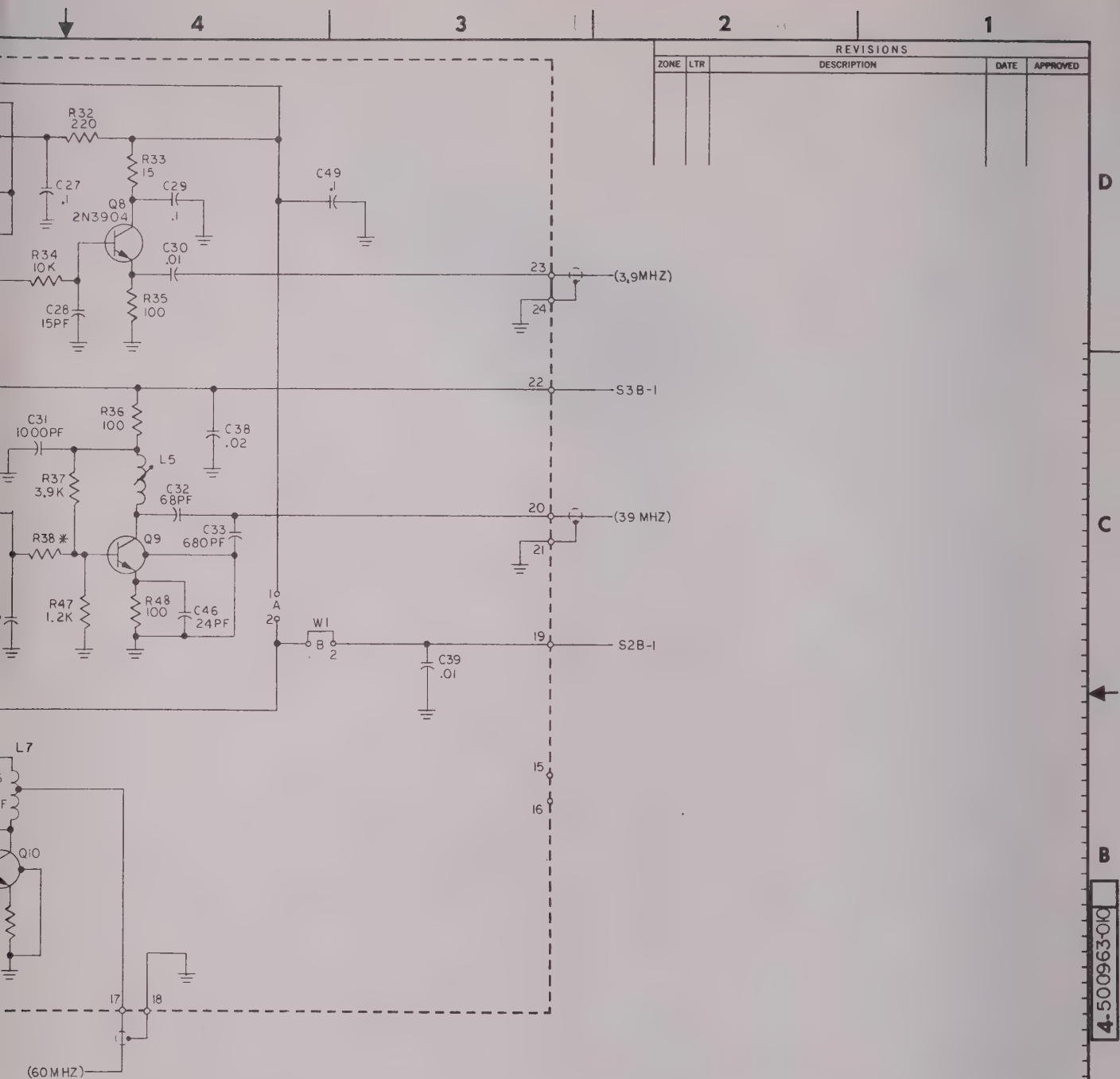
6

5

Figure 5-23. 3.7, 37 and 79 MHz



QUANTITY REQUIRED		DESCRIPTION		PART NO.		ITEM	
C41, 47, 48		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DIMENSIONS		CONTRACT NO.		SINGER	
REF DES NOT USED		DECIMAL ANGULAR		NAME DATE		THE SINGER CO - METRICS DIV	
CR2		2 PLACE ± ~		DRAWN		GERTSCH DEPT. LOS ANGELES, CALIF.	
L8		3 PLACE ± ~		CHECK		SCHEMATIC	
Q11		MATERIAL		ELEC ENGR		FREQ GEN	
C49 Y2		FINISH		MECH ENGR		(A20)	
R50 U1		MODEL NO.		APPROVED		SIZE CODE IDENT NO. DWG NO.	
LAST REF DES (INCLUSIVE)		FM-10		P. Q. 4 Dec 69		D 88869 4-500963-009	
						SCALE ~ SHEET 9 OF 10	



QUANTITY REQUIRED		DESCRIPTION		PART NO.	ITEM
-005	-004	-003	-002	-001	
C47.48		CONTRACT NO.		LIST OF MATERIALS	
C37.40,41,42,43,45		NAME		SINGER	
R41,42,43,44		DATE		THE SINGER CO - METRICS DIV	
REF DES NOT USED		DRAWN		BERTSCH DEPT. LOS ANGELES, CALIF.	
UNLESS OTHERWISE SPECIFIED		CHECK		SCHEMATIC	
DIMENSIONS ARE IN INCHES		ELEC ENGR		FREQ GEN	
TOLERANCES ON DIMENSIONS		MECH ENGR		(A21)	
DECIMAL		APPROVED		SIZE	
2 PLACE ± ~		R.G. 4 Dec 69		CODE IDENT NO.	
3 PLACE ± ~				DWG NO.	
ANGULAR				D 88869	
± ~				4-500963-010	
MATERIAL				SCALE ~	
FINISH				SHEET 10 OF 10	
MODEL NO.					
FM-10					
LAST REF DES (INCLUSIVE)					

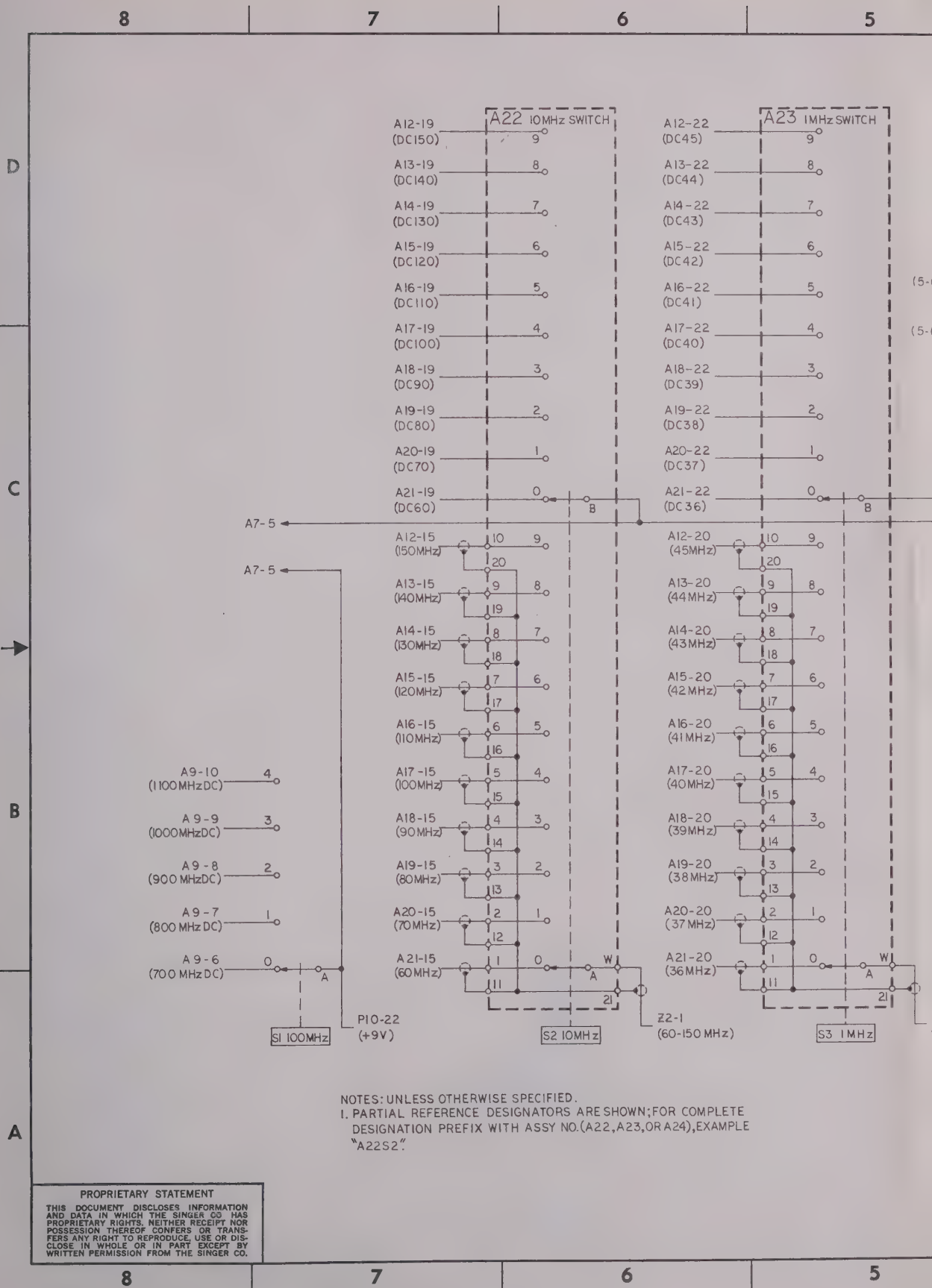


Figure 5-25. General Schematic Diagram of the 1MHz Switch (A23), 10MHz Switch (A22), and Control and Switch.



SECTION VI PARTS LIST

MAIN ASSEMBLIES

REF DESIG	DESCRIPTION	P/N
A1	Left-Hand Module Assembly	4-003097-001
A2	VCO, 6 & 9 MHz Gen Assembly	5-003082-005
A3	1KHz Decade Assembly	5-003083-005
A4	10 KHz Decade Assembly	5-003083-006
A5	100 KHz Decade Assembly	5-003083-007
A6	1 MHz Decade Assembly	5-003084-005
A7-A8	Sub Assembly	4-003098-998
A9-A10	Sub Assembly	4-003098-999
A11	TCXO & Buffer Amp Assembly	5-003089-005
A12	4.5, 45 & 150 MHz Gen Assembly	5-003088-005
A13	4.4, 44 & 140 MHz Gen Assembly	5-003088-006
A14	4.3, 43 & 130 MHz Gen Assembly	5-003088-007
A15	4.2, 42 & 120 MHz Gen Assembly	5-003088-008
A16	4.1, 41 & 110 MHz Gen Assembly	5-003088-009
A17	4.0, 40 & 100 MHz Gen Assembly	5-003088-010
A18	3.9, 39 & 90 MHz Gen Assembly	5-003088-011
A19	3.8, 38 & 80 MHz Gen Assembly	5-003088-012
A20	3.7, 37 & 70 MHz Gen Assembly	5-003088-013
A21	3.6, 36 & 60 MHz Gen Assembly	5-003088-014
A22	10 MHz Switch Assembly (S2)	3-003105-005
A23	1 MHz Switch Assembly (S3)	3-003105-006
A24	100, 10 & 1KHz Switch Assembly (S4, S5 & S6)	4-003106-005

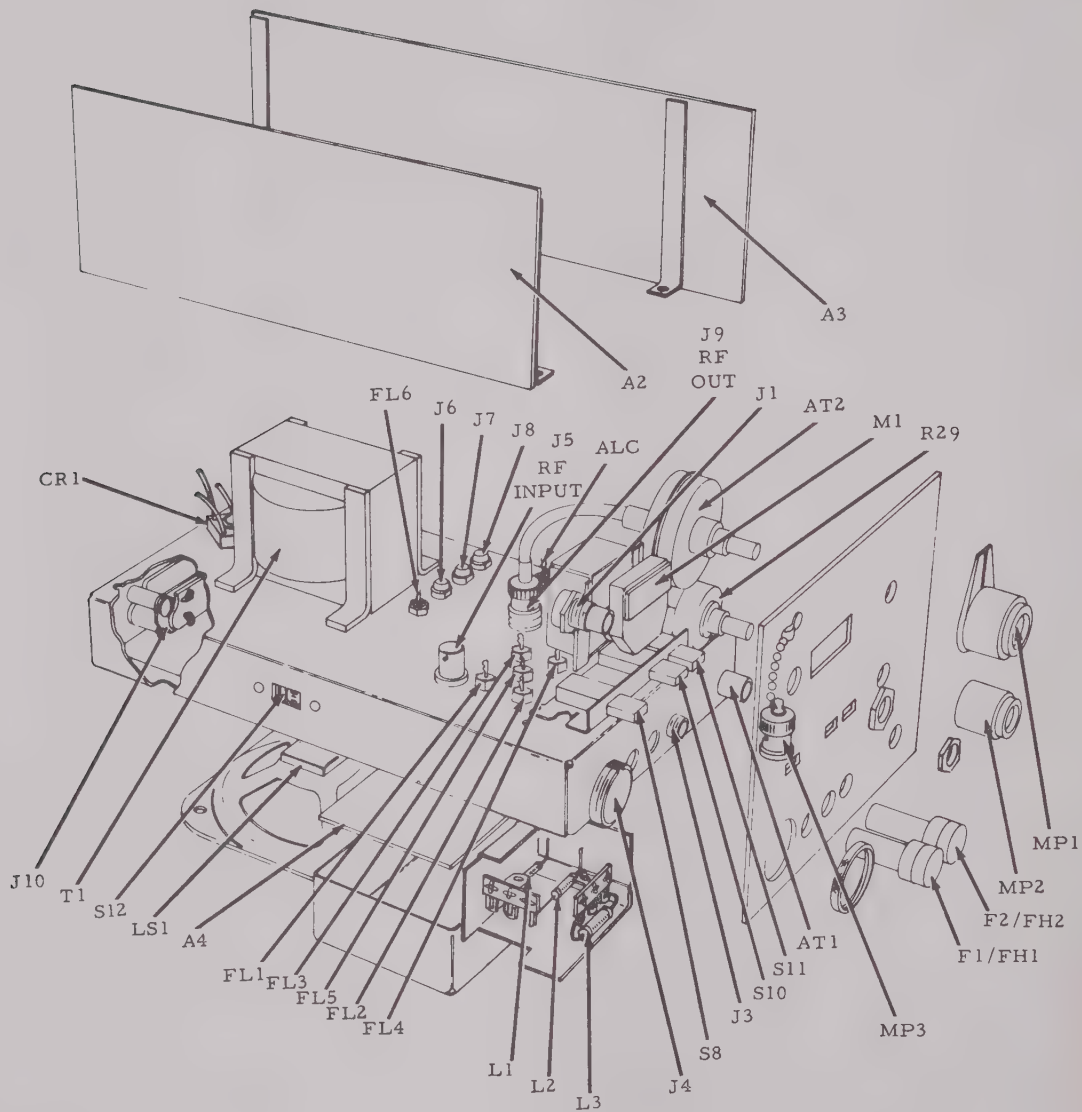


Figure 6-1. Exploded Isometric Diagram Assembly A1, Left-Hand Module

MAINFRAME

REF DESIG	DESCRIPTION	SINGER PART NO.	MFR	MFR'S PART NO.	QTY
A11 A1	TCXO crystal, 10MHz	1-402838-003	Austron	91707	1
FL1	Filter	1-402961-001	—	—	1
FL2	Filter	1-402960-001	—	—	1
FL3	Filter	2-003116-001	—	—	1
J11	Connector	1-910072-001	Amphenol	26-190-16	1
MP1	Dial Assy	3-301930-001	—	—	1
MP2 & MP3	Dial Assy	3-301930-002	—	—	2
MP4 to MP6	Dial Assy	3-301930-005	—	—	3
MP7	Knob	3-302109-001	—	—	1
MP8	Handle Assy	3-003096-001	—	—	1
MP9	Case	3-002774-001	—	—	1
P10	Connector	1-910071-002	Amphenol	26-159-24	1
Q1	Transistor	1-958039-001	Motorola	2N3055	1
S1	Switch	4-402881-001	—	—	1
S7 - R1	Resistor, variable, switched	4-403043-001	—	—	1
Z1 & Z2	Mixer	1-919009-001	Vari-L	DBM-210A	2

ASSEMBLY A1, LEFT-HAND MODULE

REF DESIG	DESCRIPTION	SINGER PART NO.	MFR	MFR'S PART NO.	QTY
A2	Divider & Auto Control Assy	4-003078-005	—	—	1
A3	Power Supply, A.F. & I.F. Amp	4-003079-005			1
A4	Broad Band Amp & Detector Assy	4-003080-005	—		1
AT1	Attenuator RFA-20A	2-001355-002	—	—	1
AT2	Attenuator	2-002761-001	—	—	1
CR1	Diode Assembly	1-913025-001	Varo	W601	1

REF DESIG	DESCRIPTION	SINGER PART NO.	MFR	MFR'S PART NO.	QTY
DS1, DS2	Lamp	1-925007-006	Mura	L-10/20	2
F1	Fuse, 3/4A	1-924000-017	Bussman	MDL	1
F2	Fuse, 3A	1-924000-027	Bussman	MDL	1
FH1, FH2	Fuseholder	1-924003-002	Bussman	HKP	2
FL1-FL6	Filter	1-919011-004	Erie Electronics	1202-051	6
J1 (SN101-400)	Connector, BNC	1-910017-007	Dage Electric	2230	1
J1 (SN401 and up)	Connector, BNC	1-910043-002	Kings Electronics	KC-19-93	1
J2	Connector	Part of AT1			1
J3	Connector	1-910077-001	Switchcraft	L112A	1
J4	Connector	1-910088-001	Amphenol	91PC4M	1
J5 (SN101-400)	Connector, BNC	1-910017-007	Dage Electric	2230	1
J5 (SN401 and up)	Connector, BNC	1-910043-002	Kings Electronics	KC-19-93	1
J6-J8	Connector	1-910026-001	Switchcraft	3C1054A	3
J9 (SN101-400)	Connector	1-910017-007	Dage Electric	2230	1
J9 (SN401 and up)	Connector, BNC	1-910043-002	Kings Electronics	KC-19-93	1
J10	Connector	1-910072-002	Amphenol	26-190-24	1
L2	Choke, 3.9 μ H	1-906002-008	—	—	2
L3	Choke, 1.8 μ H	1-906009-001	J.W. Miller	—	1
LS1	Loudspeaker	1-936001-001	Quam	597-1	1
M1	Meter	1-937003-001	Mura	TS-151	1
MP1	Knob	1-935011-001	Buckeye	—	1
MP2	Knob	1-935002-002	Buckeye	RSSN - 70 - 2	1
MP3	Cap, BNC Connector	1-910118-001	Dage Electric	366-1	1
R29	Resistor, variable	1-945009-001	CTS	Series 45	1

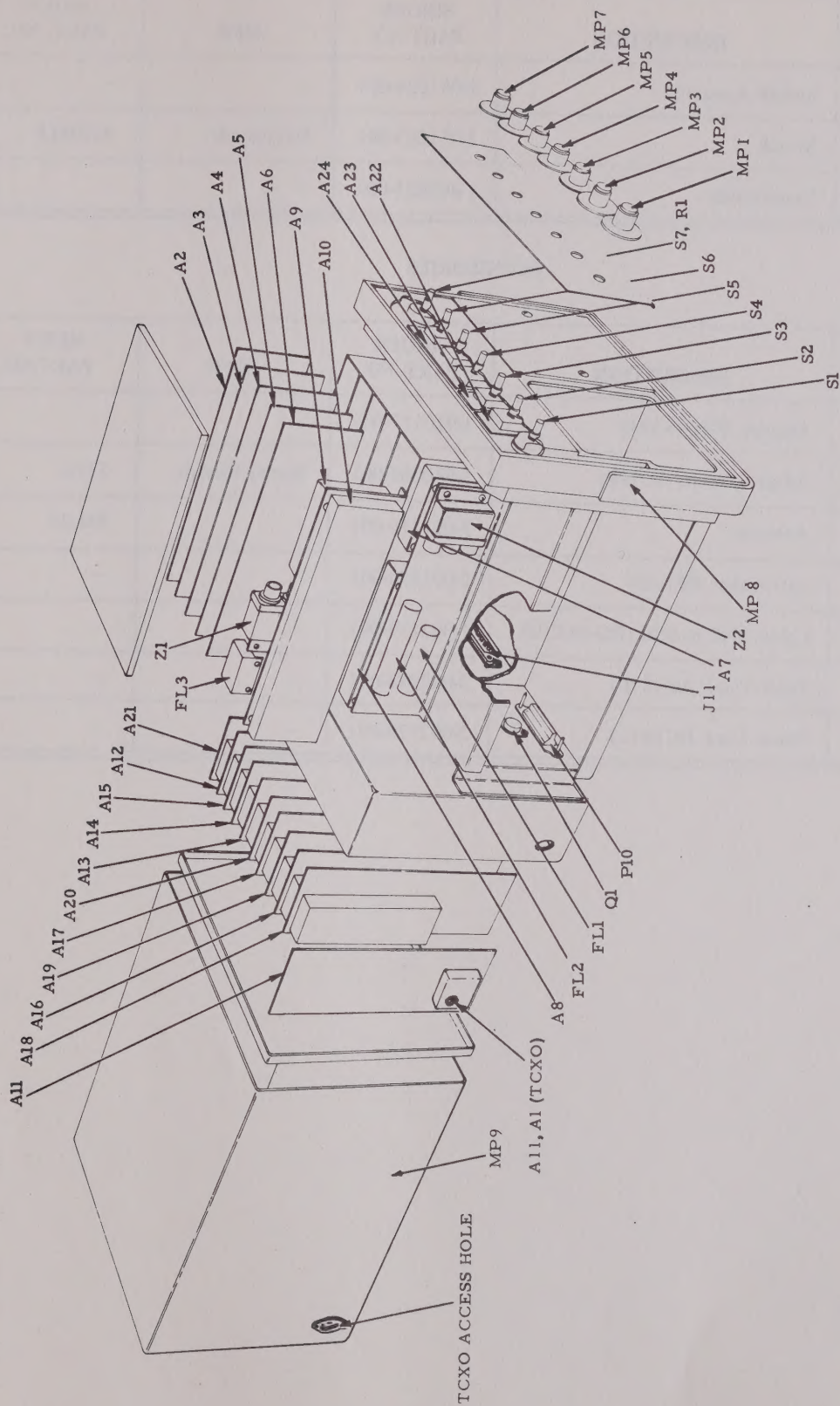


Figure 6-2. Exploded Isometric Diagram, Mainframe (A1 Removed)

REF DESIG	DESCRIPTION	SINGER PART NO.	MFR	MFR'S PART NO.	QTY.
S8, S10, S11	Switch Assembly	1-951024-001	—	—	1
S12	Switch	1-951003-001	Switchcraft	46206LF	1
T1	Transformer	1-402835-001	—	—	1

ACCESSORIES

REF DESIG	DESCRIPTION	SINGER PART NO.	MFR	MFR'S PART NO.	QTY.
	Adapter, BNC to UHF	1-910117-001		—	1
	Adapter, 3-wire AC plug	1-910003-001	Bryant Electric	5272	1
	Antenna	3-001416-001	—	EM-24	1
	Attenuator, RFA-20	2-001355-001	—	—	2
	Cable, BNC to BNC (RG-58 C/U)	1-003159-001	—	—	1
	Power Cord, AC (8 ft.)	2-002978-001	—	—	1
	Power Cord, DC (6 ft.)	2-002979-001	—	—	1

